

MORTUARY TRADITION AND SOCIAL TRANSFORMATION DURING THE LATE  
INTERMEDIATE PERIOD (A.D. 1100-1450): A BIOARCHAEOLOGICAL ANALYSIS OF  
ABOVE-GROUND BURIALS IN THE COLCA VALLEY, PERU

By

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For my grandparents

Rafael Velasco  
María Lupe Velasco

Félix M. Portilla  
Ana Luisa Portilla

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## CHAPTER 1

### INTRODUCTION

Faced by the fact of death, human cultures have developed remarkably complex and diverse practices to cope with the uncertainty and instability it occasions. From a general perspective, funerary practices involve the transformation of substances; the once-living body becomes a watchful ancestor, journeying soul, nourishing animal, towering statue, or any number of material or immaterial forms (Bloch and Parry 1982; Conklin 2001; Fontein and Harries 2013; Salomon 1995; Verdery 1999). These myriad transformations incorporate the dead into broader cosmologies that link the animate and inanimate, divine and human, past and future, and in so doing, reaffirm the basic ontological and ideological foundations of social order. Because of its pivotal role in the imagining and making of ideal society, the mortuary process can be fraught with contestation over the proper manipulation of the body, its place and manner of burial, if and how the dead are memorialized or forgotten. Struggles over burial and the dead body call attention to the politics of death and the pivotal role that mortuary practices play in both the preservation and transformation of relationships of power, difference, and inequality.

This dissertation explores the historically contingent relationship between mortuary practice and the making of social order during a critical juncture in Andean prehistory that followed the collapse of one empire and conditioned the rise of another—the famous Inka Empire of South America. During this era, known as the Late Intermediate Period (LIP, A.D. 1000-1450)<sup>1</sup>, conflict engulfed communities across the central and southern highlands (Arkush

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<sup>1</sup> This temporal designation derives from Rowe's (1945) traditional chronology, which alternates between horizons and intermediate periods. The Late Intermediate Period, also known as the Regional Development Period, marks the "interregnum" between Wari/Tiwanaku and Inka dominance. Therefore, its start date (A.D. 900-1100) varies slightly according to the timing of Wari and Tiwanaku collapse in the heartland and hinterland. On the opposing

and Tung 2013; Covey 2008). Rising above the river valleys and flat plains of the highest mountain range in the Americas, hilltop battlements and refuge sites testify to a political climate of hostility that lasted over four centuries (Arkush 2011; Kohut 2016). Patterns of cranial trauma during the LIP also speak to intense and pervasive violence, which remained at high levels at least throughout the early years of Inka state formation (Arkush and Tung 2013; Kurin 2016b). These material correlates and their high frequencies across the south-central Andes have led researchers to predominantly characterize the LIP as a time of political segmentation, ecological instability and internecine conflict—what Arkush (2013) elegantly summarizes in the Arab proverb: “I against my brother, I and my brother against our cousin, my brother and our cousin against the neighbors, all of us against the foreigner” (Salzman 1978:53 in Arkush 2013).

However, in spite of (or because of) its bellicose circumstances, this was also an era of profound cultural innovation and social transformation, as local communities reforged political, economic, and religious order in the absence of state hegemony (Conlee 2003; Guengerich 2015; Janusek 2005; Kurin 2016b; Parsons, et al. 1997). Complex systems of resource exchange and ritual interaction among coastal fisherfolk, valley agriculturalists, and high altitude herders facilitated the movement of products from different ecological zones, which not only buffered communities living in marginal environments but also underwrote an incipient elite political economy that would later flourish under Inka rule (Parsons, et al. 1997; Wernke 2013). Perhaps as an effort to make permanent their ties to the terrain upon the shifting political landscape, people also began “bringing out the dead,” housing and feting the mummified bodies of ancestors in above-ground open sepulchers, often located in boundary zones or along or near

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end, Inka influence in some provincial regions likely predates the A.D. 1450 (D’Altroy et al. 2007; Pärssinen and Siiriäinen 1997). In this dissertation, new radiometric data are presented to contextualize bioarchaeological and mortuary evidence in relation to political developments of the late prehispanic period.

defensive walls (Kesseli and Pärssinen 2005; Mantha 2009; Nielsen 2008). This novel but aesthetically variable mortuary tradition proliferated across the south-central Andes during the LIP and is the subject of the present study.

### Bioarchaeological Approach to Late Prehispanic Mortuary Politics

Commonly termed *chullpas*,<sup>2</sup> open sepulchers emplaced ancestors on the social and physical landscape and enabled the continued interaction between the living and the dead, but their political significance and emergence in time remains poorly undertheorized. *Chullpas* are traditionally thought to have marked the social and territorial boundaries of *ayllus*, competing landholding groups based on descent—a hypothesis that echoes classic mortuary axioms that link formal burial to the demarcation of resource rights tied to corporate group identity (Bloch 1981; Isbell 1997; Morris 1991; Saxe 1970). This dominant interpretation, however, is challenged by alternative models of mortuary ceremonialism that emphasize the role of *chullpa* burial practices in promoting inter-zonal exchange relationships, especially in the context of inter-elite alliance (Parsons, et al. 1997; Stanish 2012). Moreover, the connection between *ayllus* and *chullpas* predominantly derives from Spanish ethnohistoric observations, and its facile projection to prehispanic mortuary traditions ignores the volatile and highly contested political arena in which Early Colonial mortuary practices were written about, remembered, strategically deployed by Andean actors, and violently erased by Spanish extirpators (Gose 2008; Salomon 1995).

Through the lens of mortuary politics (Brown 2008; Verdery 1999), this dissertation approaches the late prehispanic *chullpa* phenomenon not as symptomatic of a fragmented social

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<sup>2</sup> As applied to above-ground funerary structures, the term *chullpa* is essentially a category constructed by archaeologists. As an indigenous term, *chullpa* may have originally referred to the body/bundle placed in the open sepulcher, rather than the sepulcher itself (Rydén 1947 in Stanish 2012). Possible emic terms for above-ground tombs include *amaya uta* (“house of the soul”) and *pucullo* (Guaman Poma de Ayala et al. 1987; Stanish 2012).

landscape, but as a constitutive element in its negotiation and transformation across time. Did the emergence of above-ground mortuary practices during a time of warfare and social strife consolidate fault lines of conflict by reifying group divisions, or alternatively, did they provide a platform for cooperation by promoting alliance and exchange? Drawing from major theoretical interventions in the archaeology of mortuary practices, these alternatives are synthesized into two heuristic models. The *corporate group model* highlights exclusionary politics as a means of marking group differences, consolidating resource rights, and ensuring group autonomy (Bloch 1981; Goody 1962; Isbell 1997). In contrast, the *inter-group alliance model* calls attention to the integrative capacity of burial for bringing together diverse social groups, forming marriage alliances, and promoting economic exchange (Buikstra and Charles 1999; Carr 2006; Dillehay 2007). A third scenario explores dynamic configurations of these two models, recognizing that mortuary differentiation and communalism often operate in tandem along different scales of social inclusion.

Methodologically, this dissertation embraces a bioarchaeological approach that situates the human body—living and dead—at the interface of human agency and social change (Crandall and Martin 2014). Bioarchaeology can trace how relationships of affinity, difference, and inequality are quite literally inscribed onto the body through intentional and habitual practices (Sofaer 2006). These embodied identities can then be compared against the treatment of the body at death to explore how mortuary practices communicate particular aspects of social experience while silencing others.

To date, most studies of above-ground mortuary practice in the Andes prioritize the tomb itself, without problematizing who was actually buried in them (Duchesne 2005; Isbell 1997). The architecture, spatial distribution, or stylistic features of *chullpas* are analyzed to infer group

dynamics and boundaries (Hyslop 1977; Kesseli and Pärssinen 2005; Mantha 2009). However, this “view from above” is liable to overlook meaningful temporal variation in *chullpa* practices, reduce tombs to function, and generalize the social identities of the deceased under what Miller Bonney (2014: 160) terms “the essentialist rubric of ancestor veneration.” The analysis of human skeletal remains, often lacking from *chullpa* studies because of pervasive looting, can shed light on the social identities of the deceased independent of the inferences made from ethnohistoric documents or the built landscape.

The methodological approach of this study is also distinctly localistic and diachronic, documenting bioarchaeological patterns of similarity and difference within a single above-ground burial tradition across time. Three bodies of data were analyzed because they directly or indirectly speak to the core assumption that *chullpa* burial practices were primarily aimed at maintaining social boundaries, descent lines, and resource control. Specifically, this dissertation analyzes: 1) cranial vault modification, to explore if mortuary treatment reinforced social differences marked on the body; 2) cranial non-metric traits, to infer if cemeteries were organized by biological kinship; and 3) stable carbon and nitrogen isotope ratios from adult bone collagen, to reconstruct foodways and shed light on patterns of resource access. By bringing these data into conversation with other archaeological and ethnohistoric evidence on mortuary monumentality, segmentary organization, and subsistence practice in the Andes, this dissertation puts forth a novel perspective on the lived experience of social inclusion and exclusion during the LIP and how it structured—and was structured by—the treatment of the body in death.

## Research Questions

The central research question of the dissertation asks if mortuary practices intensified social fragmentation and conflict by marking inter-group differences, or if they provided a vehicle for social solidarity and resource exchange by promoting the integration of ancestors from diverse social groups. This overall focus is divided into three specific research questions, each centered on a line of bioarchaeological data and the analysis of its synchronic and diachronic variation.

- 1) *Cranial vault modification*. Were individuals with cranial vault modification (CVM) treated differently in death? Inter-group differences in CVM prevalence and type will test if CVM, as a proxy of social affiliation, reinforced boundaries based on burial location. Was this unique bodily practice restricted to particular social groups or individuals, or did it serve as a more encompassing ethnic or regional identifier? Also, how did patterns of CVM change over time, and what might that suggest about changing social boundaries, particularly in relation to social and political transformations of the LIP?
- 2) *Biological distance*. Are open sepulchers organized around biological kinship? In this study, patterns of phenotypic similarity serve as a proxy of biological kinship and will be used to evaluate scenarios of boundary maintenance via endogamy or alliance formation via intermarriage. Specifically, does phenotypic variation within and between subgroups based on sex and cranial modification point toward group-specific migratory patterns? If so, what does this suggest about the relationship between social identity, alliance formation, and mortuary practices in the late prehispanic period? Do these patterns of affiliation change over time?



- 3) *Stable isotope analysis of diet*. How were resources distributed across burial groups? In this study, dietary reconstruction based on stable carbon and nitrogen isotope analysis will be used to assess patterns of resource access and subsistence differentiation. In turn, what role did mortuary practices play in consolidating economic relationships between and among social groups who utilized separate burial chambers? Finally, how does diet change over time during the politically and ecologically tumultuous LIP?

Analyzing these three lines of bioarchaeological data together and in conjunction with other mortuary evidence will reveal how different aspects of social identity dynamically intersect to shape an individual's life experience, treatment after death, and ultimate transformation into ancestorhood. Precisely where these different lines of data are not concordant with one another will be most useful for interpreting the *intentional* construction of affiliation and difference in the realm of mortuary politics and beyond (Stovel 2013)

### The Case of the Collaguas

A rich tradition of archaeological and ethnohistoric research in the Colca Valley strongly contextualizes the bioarchaeological approach to mortuary politics advanced in the present study (Denevan 1986a; Doutriaux 2004; Pease G.Y. 1977a; Treacy 1989; Wernke 2013, inter alia). From ethnohistoric accounts, we know the valley was home to two major ethnic polities during the LIP and Late Horizon (A.D. 1000-1532), the Collaguas and Cabanas, who occupied the upper and lower valley, respectively. These two groups distinguished themselves by dress, language, and cranial modification style (Blom 2005; Ulloa Mogollon 1965 [1586]). The Collaguas and Cabanas were also broadly oriented toward distinct subsistence regimes. Camelid herding and fiber production in the upper reaches of the valley underwrote Collagua political

economy in the early colonial period and almost certainly during Inka rule, if not earlier. Meanwhile, the lower-lying Cabanas region, ideal for intensive maize cultivation, held the reputation as a “breadbasket” of the Inka Empire. Beyond these valley-wide ethnic distinctions, Wernke (2013) illustrates how a complex system of moieties, sub-moieties, and descent groups structured landholding patterns in different ecological zones. How did mortuary practices consolidate or cut across these territorial or political-economic divisions?

Other features of the cultural landscape allude to the intricate, and at times contentious, ways that identity, resource rights, and authority were negotiated during the late prehispanic period. A complex network of irrigation canals that channeled glacial melt to agricultural terraces would have required coordinated (if not centralized) management (Treacy 1989; Wernke 2007a). At the same time, disputes over water rights likely contributed to conflict in the past and even continue to be a source of conflict among present-day communities (Gelles 2000). Hilltop fortifications (*pukaras*) throughout the central and upper valley also provide strong evidence of intra-valley hostility and/or mobilization against outside threats (Wernke 2013; see also Kohut 2016). Examining how above-ground tombs were incorporated into these processes of coordination and conflict will further elucidate the nature of social interaction and community formation during the LIP.

## Study Sample

Archaeological excavations of two above-ground mortuary sites in the central Colca Valley were conducted in 2012 as part of Proyecto Bio-arqueológico Coporaque (RD No. 374-2012; Ferrando Verástegui and Velasco 2014). These sites, Yuraq Qaqa (CO-098) and Sahuara (CO-118), are presented in detail in Chapter 4. Because of extensive looting, loose skeletal

elements from above-ground chambers cannot be associated to reconstruct complete skeletal individuals. Accordingly, this dissertation focuses primarily on the intact crania, since the human cranium allows for the integration of non-metric, dietary, and CVM data classes. In all, a total of 148 crania were recovered from six distinct mortuary chambers at Yuraq Qaqa, and another 83 individuals from two commingled chambers at Sahuara, for a total MNI of 231. Thousands of postcranial elements were also recovered, but they are not analyzed in the present study. Fifteen new radiocarbon dates from human bone and mortar used in tomb construction were used to divide the sample into the Early LIP (A.D. 1150-1300) and Late LIP (A.D. 1300-1450).

### Structure of the Dissertation

The organization of the dissertation is as follows: Chapter 2 summarizes previous ethnohistoric and archaeological research on the Colca Valley and its inhabitants. Existing data on political, economic, kinship, and ethnic structures in the valley, and their transformation under Inka governance, will contextualize the hypotheses presented in Chapter 3. Specifically, Chapter 3 synthesizes two heuristic models of mortuary practice that contrastingly highlight strategies of social differentiation or integration and situates them within broader anthropological theory and the political context of the LIP. This chapter also reviews the past forty years of mortuary studies in anthropology and identifies distinct theoretical approaches that have implicitly or explicitly influenced interpretations of *chullpas* in the Andes. Finally, Chapter 4 details the research sample and the three bioarchaeological methodologies that will be brought to bear on the social identities of the deceased: cranial vault modification (CVM), biological distance, and stable isotope analysis.

Results of the bioarchaeological analyses will structure the remaining data chapters. Chapter 5 explores the social significance of CVM as a salient marker of identity, analyzes its correlation with burial location, and investigates how the practice changed in prevalence and form over time. Age and sex distributions are briefly discussed here in order to explore their relationship to CVM patterns. Chapter 6 explores whether or not cemeteries reflect kinship organization by analyzing patterns of within-group and between-group variation in the presence and absence of cranial non-metric traits. Sex-specific phenotypic variation is also analyzed to assess patterns of post-marital residence, which can shed light on strategies of alliance formation in the past. In Chapter 7, the analysis of stable carbon and nitrogen isotopes will further clarify the social correlates of CVM and examine if individuals with distinct subsistence practices (i.e., agriculturalists vs. pastoralists) were buried in the same mortuary chambers. In Chapter 8, these data classes are integrated and compared against the heuristic models of social differentiation and integration presented in Chapter 3. New insights into late prehispanic ethnogenesis and Inka state formation are also synthesized. Finally, this chapter summarizes the findings of the dissertation and their anthropological significance for the study of mortuary politics in the past and present.

## Significance

As an era defined by its political and ecological instability, the Late Intermediate Period provides a natural laboratory for examining how tombs and corpses intervene in processes of political reorganization, conflict, and cooperation. The proper burial and social memory of ‘those who came before us’ not only animates our sense of belonging and community, but also has the power to reorder the political universe (Verdery 1999; Weiss-Krejci 2011). In essence, then, this

dissertation is the story of how the ancient Collaguas embodied and made material their vision of social order during uncertain and stressful times. Through a body-centered approach to burials and boundaries in the late prehispanic Andes, this dissertation contributes to anthropological theory that seeks to understand the politics of the living in their relationship with the dead.

## CHAPTER 2

### PHYSICAL, CULTURAL, AND MORTUARY LANDSCAPES OF THE COLCA VALLEY

#### Introduction

The Colca Valley is an ideal research setting to explore the social and biological dimensions of above-ground mortuary practices during the late prehispanic era. A large corpus of data from over half a century of archaeological research in the valley will richly contextualize the bioarchaeological analysis presented in this dissertation (see, *inter alia*, Cook 1982; Denevan 1986a; Neira Avendaño 2011 [1961]; Treacy 1994; Wernke 2013). During the Late Intermediate Period and Late Horizon (A.D. 1000-1532), two major ethnic groups, the Collaguas and Cabanas, occupied the upper and lower Colca Valley, respectively. These two ethnic groups were broadly oriented toward different subsistence regimes (camelid pastoralism vs. maize agriculture), spoke different languages (Aymara vs. Quechua), and purportedly displayed ethnic identity through distinct cranial modification styles (annular vs. tabular erect) (Blom 2005; Doutriaux 2004; Pease G.Y. 1977b; Ulloa Mogollon 1965 [1586]). How rigidly these cultural and economic practices structured social boundaries in life, and whether or not they represent late developments in prehistory occurring at the onset of Inka imperialism, remain unclear (Doutriaux 2004; Wernke 2013).

In this chapter, I review previous archaeological and ethnohistoric research in the Colca Valley in order to situate my analysis of biosocial diversity within the cultural, physical, and political worlds inhabited by the Collaguas and Cabanas. First, I present an overview of the valley's ecologically-graded environment, which shaped subsistence practices at the same time that it was transformed via impressive feats of landscape modification and hydraulic engineering.

Special attention is given to the local geographical and hydrological landscape surrounding the modern district of Coporaque, where the study sites are located. Next, I review the major archaeological research projects in the region and draw on their findings to summarize culture history, from the time of archaic hunter-gatherers to the period of Inka imperialism. The current mortuary record for the Colca Valley, its relative chronology and implications for social diversity and stratification are discussed in the penultimate section. The final section synthesizes archaeological and ethnohistoric data to present a comprehensive picture of the social, economic, and political structures that shaped community formation during the late prehispanic period. This synthesis will inform the bioarchaeological correlates presented in Chapter 3.

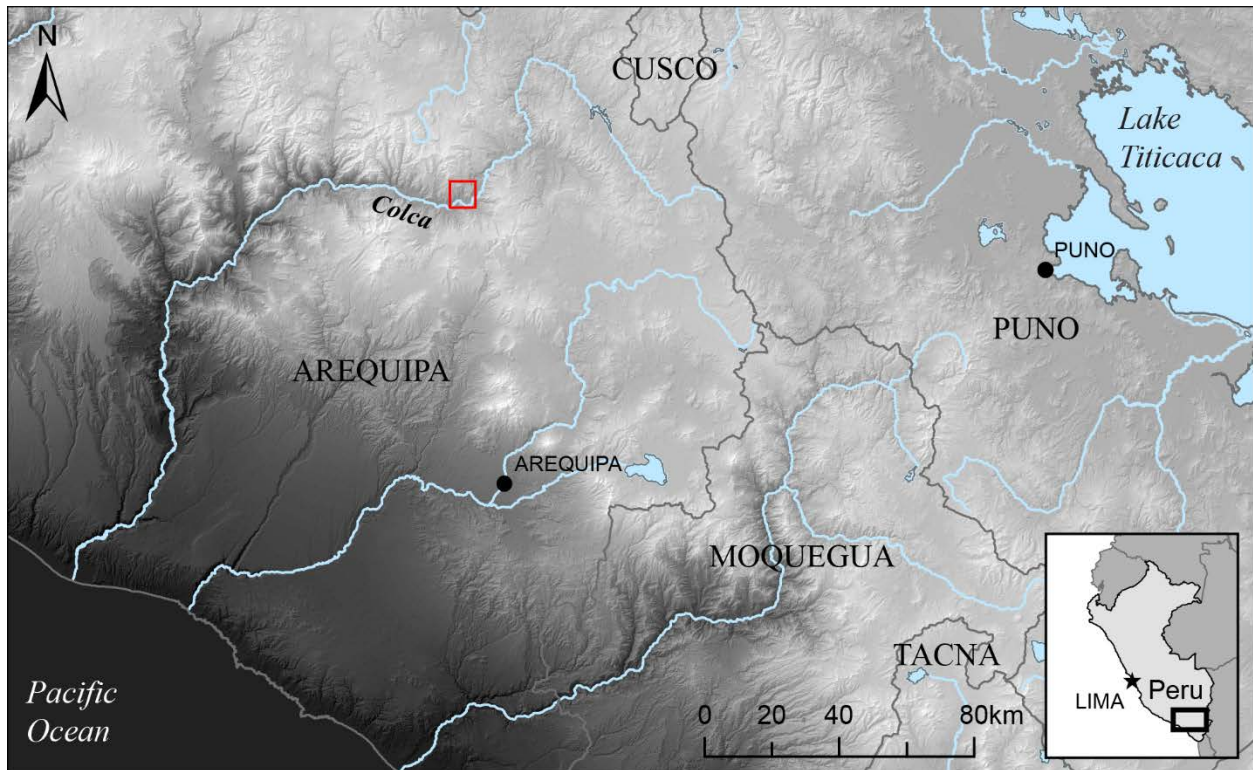


Figure 2.1. Map of the southern Andes, with modern departmental borders and capitals. Red box indicates study area in the Colca Valley.

## Environmental Setting

### *Geography, Climate, and Ecology*

The Colca Valley is a cool, semi-arid valley of the southern Peruvian Andes (Province of Caylloma, Region of Arequipa), that forms the upper stretches of the Colca-Majes-Camaná drainage and lies approximately 175 km due west from the Lake Titicaca basin, with which it shared social, cultural, and economic ties in the past (Figure 2.1). The valley is located in an area of active volcanism, which produced outcrops of high-quality obsidian that served as a key source of lithic raw material for millennia (Burger, et al. 2000; Tripcevich 2007). The valley's southern viewshed is dominated by three snow-capped stratovolcanoes in close proximity (as shown in Figure 2.2): Hualca Hualca (6,025 masl), Ampato (6,288 masl), and Sabancaya (5,976 masl). Closer to the study area, the smaller peaks of Huarancate (5,400 masl) and Mismi (5,597 masl) provide snowmelt for the principal irrigation canals that feed agriculture on the northern and southern basins of the river. Precipitation also constitutes an important but less reliable water input, directly watering fields and feeding into canals secondarily (Waugh and Treacy 1986).



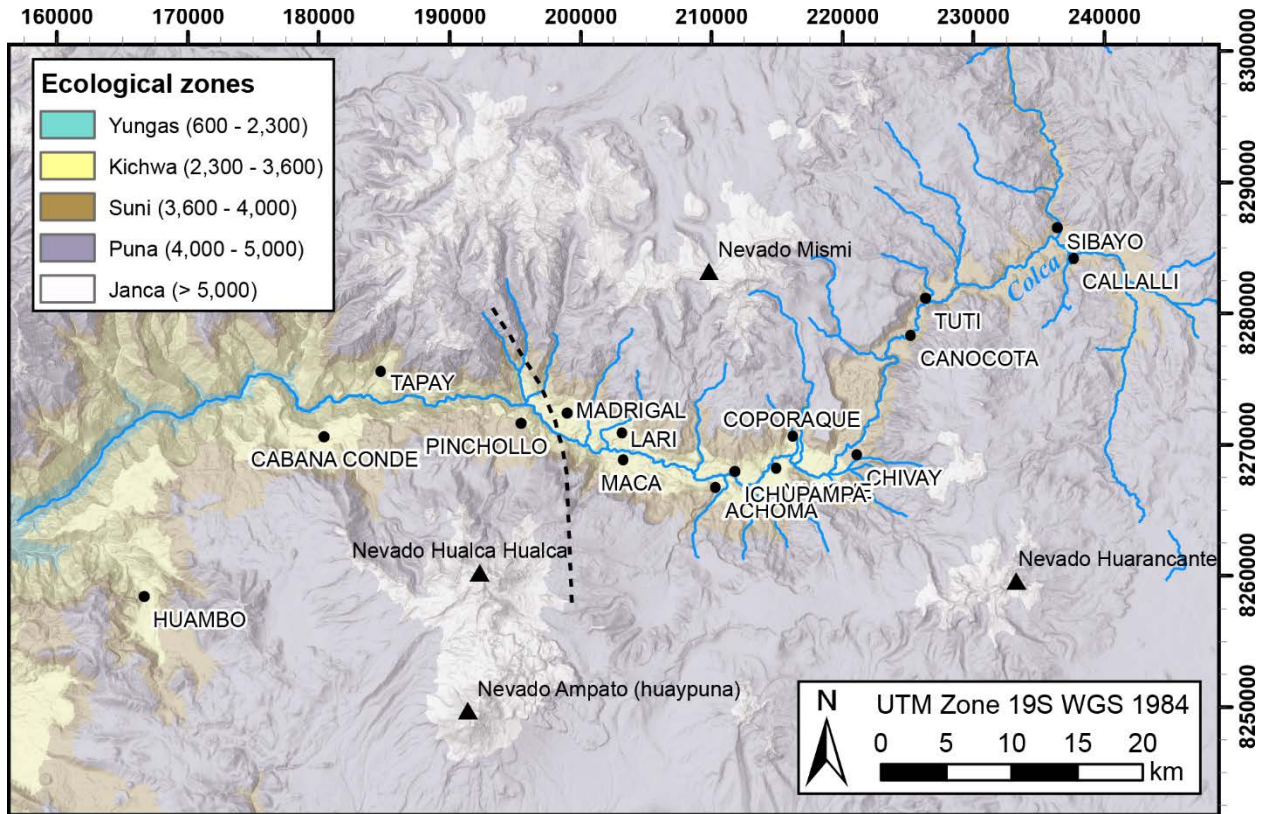


Figure 2.2. Map of the Colca Valley. Approximate boundary between Collaguas and Cabanas indicated by dashed line.

The Colca River originates in the wetlands of the high Andean plateau (altiplano), moving northwest at a low gradient before making an abrupt southwestward turn ten kilometers north of the village of Tisco (Tripcevich 2007). Running a southwestern course, the river passes the large herding villages of Sibayo and Callali, gradually descending toward the town of Chivay, the modern-day gateway to the Colca Valley (Figure 2.2). There it adjusts its course to the west and winds along a deeply incised river valley before reaching the precipitous Colca canyon.<sup>3</sup> Exiting the canyon, the river eventually merges with the Andamayo River and changes

<sup>3</sup> See Tripcevich (2007) and Wernke (2003) for detailed descriptions of Colca valley geomorphology.

names to the Majes River and ultimately the Camaná River before draining into the Pacific Ocean.

For an approximately 50 km east-west stretch, from Chivay (3,635 masl) to Cabanaconde (3,287 masl), the Colca River's course is dotted by small villages built on the broad alluvial terraces rising above either side of the valley floor (Figure 2.2). This area follows the general climate pattern of the high altitude Andes, with alternating wet and dry seasons. The majority of annual precipitation falls during the months of December to March, and temperatures are slightly lower during the rainy season, although diurnal temperature variation exceeds seasonal fluctuations (Denevan, et al. 1986). Year-to-year oscillations in precipitation are considerable, however, and unpredictable rainfall has led to important agricultural innovations, namely a complex terrace and irrigation system along with the equally intricate social customs and regulations that govern its management (Gelles 2000; Treacy 1994).

Average annual precipitation and temperature vary by elevation, carrying important implications for agricultural and economic productivity in the valley. The lower valley (2,800-3,400 masl), where temperatures are generally warmer and crops are less prone to frost, receives an average of 350 mm of rain fall each year, although this is highly variable. The microclimate is best suited for maize agriculture and can sustain the limited cultivation of fruits deeper within the canyon. By all accounts, maize production in the lower valley strongly appealed to the economic interests of the Inka state, and even today, *maiz cabanita* is “famous throughout the southern Andes for its taste and quality” (Gelles 2000: 13). In ancient times, agriculture fields in and around the large village of Cabanaconde were fed by snowmelt from Hualca Hualca, transported via the Huataq Canal, which Gelles (2000: 54) suggests was constructed under Inka auspices.

The central valley, which includes the Yanque and Coporaque districts, receives 400 mm of rain each year, on average, with approximately 75% falling during the rainy season (Treacy 1994). Average monthly temperatures range from 8.1°C in the dead of winter (June and July) to a 12°C peak around the onset of the rainy season.<sup>4</sup> The central valley mostly spans the upper *kichwa* and *suní* ecozones (3,400-4,000 masl) and maintains more direct access to the *puna* grasslands (4,000-5,000 masl), compared to the lower valley. Maize cultivation also predominated in the central valley during the early colonial era, accounting for nearly 60% of cultivated land in early colonial censuses (1591-1617) in the Coporaque area (Benavides 1986; Wernke 2013). Other major crops declared in the census, and likely consumed during prehispanic times, include quinoa and a variety of potatoes. Barley and alfalfa were added to this repertoire after contact, as they are well-adapted to frost and drought (Treacy 1994).

Upstream of Tuti (3,837 masl), the upper valley marks the limits of agricultural production, giving way to predominantly pastoralist activities in the high altitude *puna* ecozone. Frost-resistant grasses in the bofedal ecosystem, such as *chilliwa*, provide ideal pasturage for camelid herds. Rainfall is more abundant at higher altitudes, averaging 550-750 mm a year, but average minimum temperatures are cooler by approximately 3°C, greatly increasing the risk of frost and making agriculture mostly untenable (Wernke 2003). To avoid seasonal winds and snowfall, modern pastoralist activity is more intensive during the dry season, with herds moving into the valley during the wet season (Tripcevich 2007: 316). The upper Colca is also the site of high-quality obsidian exposures, located above 4,800 masl, just about 4 km to the east of Chivay (Brooks 1998; Tripcevich 2007). In sum, distinct resource potentials in the upper and lower valleys fostered economic specialization between pastoralist and agriculturalist enclaves.

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<sup>4</sup> Average temperatures recorded during 1996-2006. These data, cited in Vera Delgado and Vincent (2013), are from the Servicio Nacional de Meteorología e Hidrología del Perú (SENAMHI).

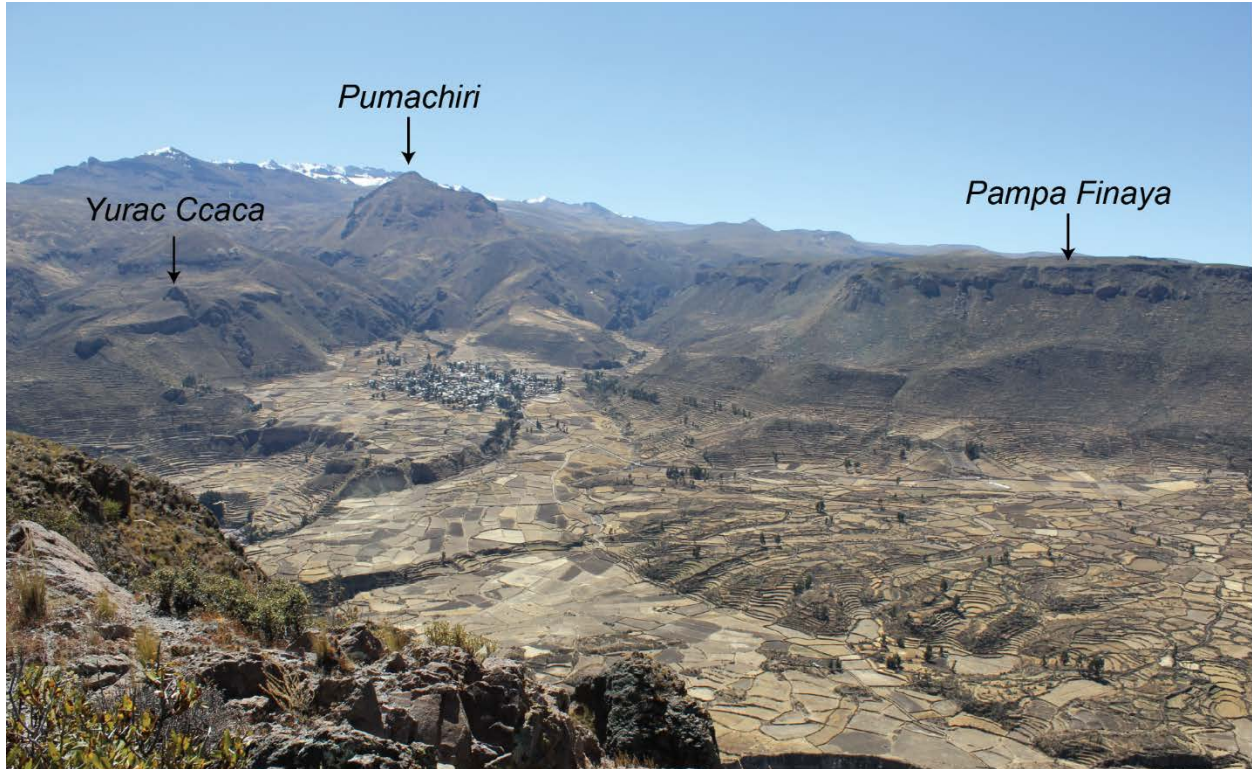


Figure 2.3. Landscape surrounding Coporaque. Photo by Lauren E. Kohut.

### *Physiography and Hydrology of the Coporaque District*

The local geography and the organization of irrigation canals in the area surrounding the modern town of Coporaque merit further description as they likely played an important role in the placement of mortuary structures on the landscape. Coporaque itself is located on the northern bank of the Colca River, nestled between three prominent landforms (Figure 2.3 and Figure 2.4). Overlooking the town from the north is the peak of Pumachiri (4,696 masl), which is considered the principal *apu*, or mountain deity, of the village.<sup>5</sup> To the east and west of the village lie the high plateau of Pampa Finaya (4,145 masl) and the hardened ash outcrop known as

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<sup>5</sup> During the late prehispanic era, it also served as a fortified refuge and lookout, maintaining a commanding view of the surrounding area and other forts (Kohut 2016; Wernke 2013).

Yurac Ccacca (3,817 masl). The summit of Yurac Ccacca broadens into a small plateau bordered on its eastern side by a rocky escarpment, where the eponymous cemetery site of Yuraq Qaqa (CO-098) is located.<sup>6</sup> Its eastern and southern slopes, carved into bench terraces and dotted by over 100 house structures, make up the archaeological sector of San Antonio/Chijra (CO-100), where the people buried at Yuraq Qaqa most likely lived.

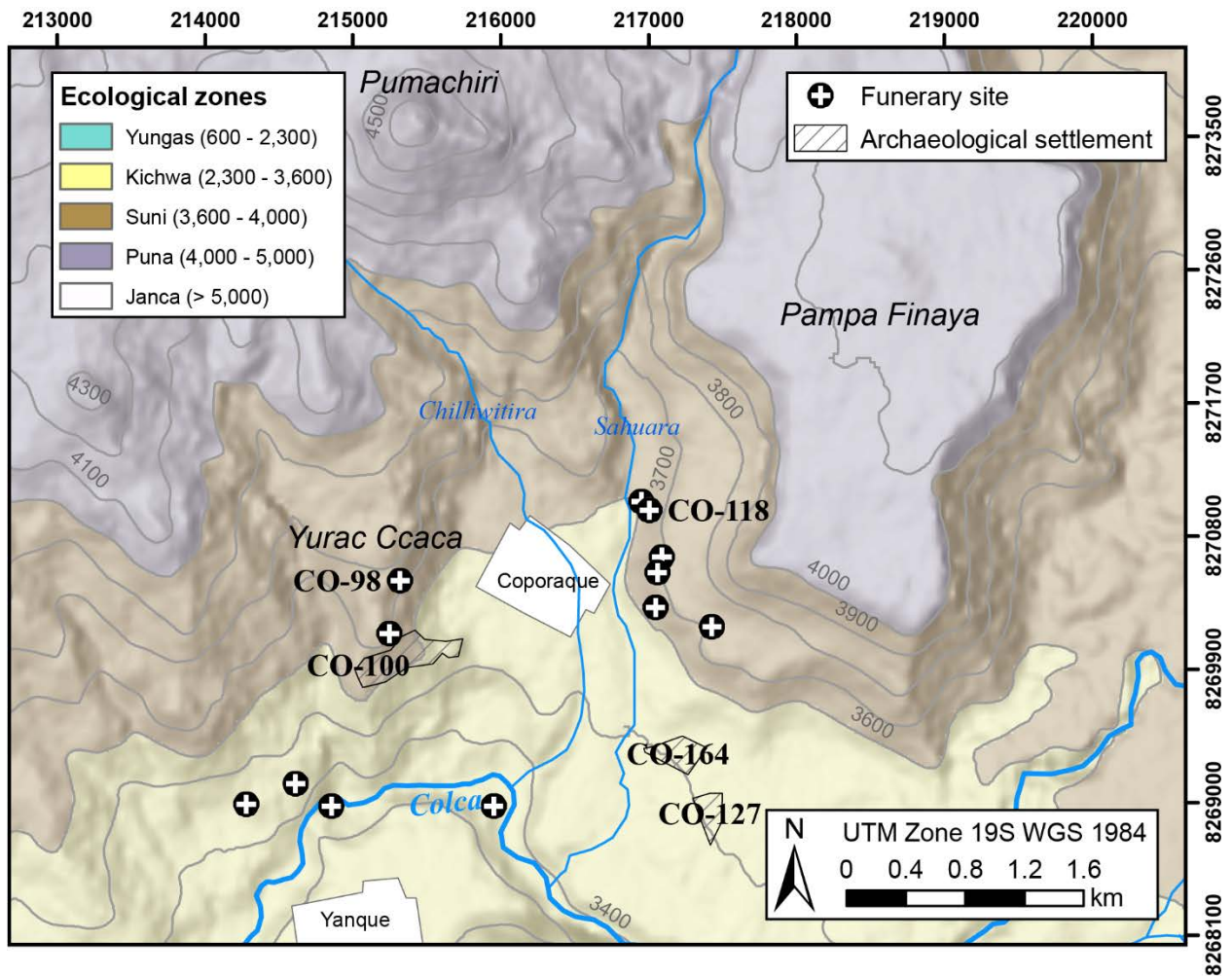


Figure 2.4. Map of the study area surrounding Coporaque. Funerary sites under study are labeled CO-98 and CO-118.

<sup>6</sup> In this dissertation, I differentiate between the geological formation and archaeological site using the Spanish orthography for the former and Quechua orthography for the latter.

Agriculture in the Coporaque area was supported by a complex system of irrigation canals that channeled glacial melt waters from Nevado Misme into subsidiary canal networks. Here I provide a brief overview of the Yanque/Coporaque irrigation system.<sup>7</sup> From its source, the primary Misme Canal carries water across a 25 km course to the agricultural lands of Yanque on the northern banks of the Colca River. Before reaching its destination, however, it collects and bypasses water from a number of smaller streams that cross its course. The first major bifurcation of the canal system involves the redirection of water from two of these streams—the Waynaqorea and the Aquentá—to the Sahuara canal to the east. The Sahuara canal flows south along the foot of Pampa Finaya to deliver water to the agricultural fields east of Coporaque that are associated with the archaeological settlements of Kitaplaza (CO-164), Llanka (CO-127), and Tunsá (CO-163). One of the Sahuara's now-abandoned feeder canals, called the Inka canal, passes just below one of the two cemetery sites (CO-118) studied in this dissertation.

About 4 km south of the confluence of the Aquentá, Waynaqorea and Sahuara, another stream traverses the Misme Canal via aqueduct and is diverted to the Chillihuitira river, which supplies water for the agricultural lands west of Coporaque. A large reservoir on the mesa-like portion of Yurac Ccacca collected water from the Chillihuitira, which in turn was carried downslope via a secondary canal to the agricultural terraces of Chijra, forming a distinct sub-unit of the local irrigation system (Treacy and Denevan 1986: 242-243; Wernke 2003). In this way, Coporaque is situated at a key hydrological division that differentiates western and eastern agricultural sectors based on their proximate source of irrigation, the Chillihuitira or the Sahuara.

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<sup>7</sup> For an exhaustive summary of the irrigation system, see Treacy (1989, 1994) and Wernke (2003, 2013), who address hydraulic engineering and built landscape, as well as the social and ritual dimensions of water management in the valley. Wernke (2013, Fig. 4.41) provides a useful schematic of the local hydrological network that feeds Coporaque and Yanque.

In fact, during the late prehispanic era, opposing *ayllu* groups predominantly held lands on either side of this hydrological, and socially significant, boundary (Wernke 2013).

Ultimately, the Chillihuitira and Sahuara feeder canals trace back to the same source (Misme), highlighting how lower-level divisions were embedded within higher-order hydrological relationships that would have necessitated cooperation between local groups at what Wernke (2007a; 2007b) calls the “political-ecological interface.” At the same time, control over limited water resources continues to be a point of contention among present-day communities, and it likely contributed to conflict in the past (Boelens and Seemann 2014; Gelles 2000; Wernke 2013). In either scenario, both archaeological and ethnographic evidence paint a picture of a hydraulic landscape that was at once symbolically rich, technologically sophisticated, and inherently political (Gelles 2000). As Wernke (2013: 144) observes, “one’s community affiliation during the LIP and Late Horizon would not have been simply a reflection of one’s village of residence, but could be scaled up and down in part by reference to the primary and secondary canals that irrigated one’s fields.”

How mortuary practices structured, and were structured by, these social affiliations and economic commitments remains poorly understood, and, at present, can only be loosely surmised from spatial organization. The placement of cemeteries on opposite sides of the Chillihuitira—and in the case of CO-118, its proximal location to a canal hydraulic feature—suggest that tombs may have reinforced ancestral claims to water and land. But for whom, and to what ends? Understanding the scale of integration at mortuary sites and their relationship to broader kinship, hydrological, and residential networks requires a theoretical and methodological approach to mortuary practice that can mediate between individual identity, social affiliation, and the built environment, without reducing tombs to functional entities on a fragmented landscape.

## Previous Archaeological Research

Within the realm of archaeology, the spectacularly terraced landscape of the Colca Valley stands as a marquee case study in cultural ecology, yet the social history of the people who shaped the landscape has only recently begun to come into focus. Neira's (2011 [1961]) seventeen-day archaeological expedition through the Colca Valley laid the foundation for subsequent research on Collagua settlement organization, domestic architecture, and mortuary practices. In all, he describes thirty-three archaeological sites stretching from the district of Chivay to the district of Huambo south of Cabanaconde, covering areas that would later be surveyed systematically by Wernke (2003) and Doutriaux (2004). His firsthand observations of fortifications, necropolises, and terraces are especially valuable in cases where looting and destruction of architectural features have since erased them from the archaeological record.

In the 1980s, the Colca Valley Abandoned Terrace Project (1983-1986), directed by Dr. William Denevan, brought the region's complex system of agricultural terraces and irrigation canals to the forefront of geographical studies of landscape modification and the built environment (Denevan 1986a). The interdisciplinary project sought to assess the timing and extent of prehispanic terrace construction and, in turn, understand how the decline in terrace utilization and agricultural productivity over the last half-millennium is related to broader demographic, social, historical, and climatic changes. Their analysis of air photos confirms that nearly two-thirds of all terraces in the valley have been abandoned since prehispanic times. In order to examine terrace antiquity and construction, the project targeted excavations of upper and lower terraces at Chijra, which carve the southern slope of Yurac Cacca (Malpass 1986).



Preliminary archaeological survey was also conducted on the opposite side of the river near the modern town of Achoma (Shea 1986a).

Based on limited archaeological excavation, ethnohistoric analysis, and ecological modeling, the interdisciplinary project put forth several hypotheses and preliminary conclusions regarding the causes of long-term terrace abandonment, which have since been refined by subsequent research. Drawing from ice core records of wet and dry periods (Thompson, et al. 1985), their research concludes that climate change was not a major factor in terrace abandonment, since rainfall was lower than average during periods of agricultural intensification and higher than average during colonial and modern times, when terrace abandonment clearly took hold. Indeed, water availability in the present day exceeds crop needs threefold, suggesting that changes in water management practices, rather than a limited water supply, may have decreased water use efficiency and agricultural productivity (Denevan 1986b: 544).

The Colca Valley Terrace Abandonment Project also called attention to the direct and indirect effects of Inka and Spanish colonialism on terrace abandonment. First, their excavations in the Chijra sector suggest that Inka intensification of maize agriculture targeted lower terraces in the *kichwa* zone. Thus, the gradual abandonment of upper slope terraces may reflect “a shift from emphasis on tubers higher up to an emphasis on maize and quinoa on the lower, warmer slopes” (Denevan 1986b: 544). They also identify large-scale and rapid depopulation during the early colonial period, due to the introduction of epidemic diseases from the Old World, as a major factor in the disuse of upper slope terraces. The Spanish *reducción* policy, which increased travel time to outlying fields and terraces, along with the introduction of new agro-ecological regimes, further altered land use patterns.

Subsequent researchers have contributed new data and interpretations regarding terrace construction, development, and abandonment. The topic of water use management and terrace abandonment was further elaborated in the dissertation of the late John Treacy (1989; 1994), a student and colleague of Denevan. Sarah Osgood Brooks (1998), another doctoral student of Denevan, took up the question of terrace origins by attempting to correlate key climatic shifts with periods of agricultural intensification. She similarly concludes that climate change did not lead to abandonment, but rather may have been “a catalyst for the adoption of technological advances and even increased productivity” (Brooks 1998: 415). Wernke (2003: 23-24) is more circumspect of models that prioritize environmental factors at the expense of the political and social structures that mediate between environment and economy. Using least-cost path simulations to analyze walking distances between Coporaque and abandoned and unabandoned agricultural fields, he shows that lower-ranking *ayllu* groups were disproportionately disadvantaged by the resettlement policies that contributed to de-intensification (Wernke 2010). The social processes and material practices through which local authority and political economy were negotiated during the colonial period continue to be an organizing theme of Wernke’s interdisciplinary research in the Colca Valley.

Despite the wealth of research into Colca Valley ecology, water management, landscape modification, and most recently, historical archaeology (Denevan 1986a; Denevan 2001; Gelles 2000; Guillet 1987; Paerregaard 2013; Treacy 1994; Vera Delgado and Vincent 2013; Wernke 2013), archaeological excavation of prehispanic domestic sites in the valley has lagged far behind. The Colca Valley Terrace Abandonment Project conducted test excavations of a house structure in the Chijra zone, documenting and uncovering ceramic fragments spanning the Collagua, Inka, and Colonial sequence (Neira Avendaño 1986). The nearby site of San Antonio

(CO-100), one of the major settlements in the central valley prior to the colonial period, woefully remains under-studied, lacking of both excavated contexts and a complete site plan. Most recently, restoration and conservation efforts at the large settlement of Uyu Uyu (YA-050) in the Yanque district were accompanied by limited archaeological excavation, but the results remain to be widely disseminated.

Since the 1980s, a number of smaller-scale projects by Peruvian and U.S. archaeologists have afforded a glimpse into domestic site organization and occupation history. At the Middle Horizon site of Achachiwa, near Cabanaconde, de la Vera Cruz (1989) excavated test pits in one of the largest house structures, recovering over two dozen Wari-influenced ceramic fragments. Guerra Santander and Aquize Cáceres (1996) and Brooks (1998) independently documented house structures and site layout at the Late Intermediate Period site of Uskallacta in the Río Japo Basin to the south of Chivay. Charcoal from a hearth excavated by Brooks provided the first well-contextualized radiocarbon date for Collagua occupation ( $855 \pm 85$  B.P., cal A.D. 1031-1379).<sup>8</sup> The results of these small-scale excavations and house surveys and their insights into social differentiation are detailed in the subsequent section.

In the last two decades, three large-scale archaeological survey projects have vastly expanded our knowledge of prehispanic social organization, resource procurement, and land use in the Colca Valley. Wernke (2003) and Doutriaux (2004), respectively working in the central valley (Yanque and Coporaque) and the lower valley (Lari and Cabanaconde), present detailed archaeological syntheses of the regional settlement pattern and its transformation under Inka rule. They also develop typologies of ceramic style and domestic and mortuary architecture,

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<sup>8</sup> All age ranges are reported to 2-sigma (95.4% probability), unless otherwise noted. Radiocarbon dates from previous research in the Colca Valley have been recalibrated using the OxCal 4.2 program and ShCal 13 radiocarbon calibration curve.

providing the foundation for new archaeological interpretations of social differentiation and chronology. Tripcevich's (2007) survey in the upper valley covers the *suní* and *puna* ecozones above Chivay and explores the social and economic contexts in which obsidian was procured, locally consumed, and exchanged across long distances. Collectively, these surveys offer the most methodologically rigorous assessment of cultural change in the Colca Valley to date. Their findings are highlighted in the summary of Colca Valley culture history below, in order to contextualize the present research.

## Culture History and Chronology

### *Archaic Period (9000 – 3300 B.C.)*

In the Colca Valley, as elsewhere in the Andes, the Archaic Period is defined by the mobile settlement patterns and foraging strategies of high altitude hunter-gatherers (Aldenderfer 2008). Tripcevich (2007) documents the heaviest Archaic Period occupation in the high *puna* area, where opportunities for camelid hunting were more ample. Evidence of short-term occupation is usually limited to debitage of obsidian and other knapping materials on the floors of cave sites or rock shelters that were used as the “logistical camps” for highly mobile foragers. Procurement and use of obsidian from natural outcrops located above 4,900 masl would have been conducted irregularly and embedded within a hunting and foraging economy (Tripcevich 2007: 489, 743). Obsidian glass was not only utilized for spear points in hunting, but also knives for shearing and butchering (Mujica Barreda and de la Vera Cruz Chávez 2002; Tripcevich 2007).

Because it was home to one of the primary sources for obsidian in the Andes, the Colca Valley was a vital node in systems of long-distance exchange throughout Andean prehistory

(Burger, et al. 2000). Brooks and colleagues (1997) determined that what had long been referred to as “Titicaca Basin obsidian” (because of its ubiquity in that region) actually sources to a quarry located 3.5 km east of Chivay, on the slopes of the Cotallalli volcano. From seven obsidian hydration dates, Brooks (1998) places human activity in the central Colca Valley possibly as early as  $12,558 \pm 489$  B.P., but certainly by the fifth millennium B.C. and continuing throughout the Late and Terminal Archaic (Brooks 1998).<sup>9</sup> Within the Arequipa region more broadly, Chivay type obsidian has been securely dated to the Middle Archaic (7000-5000 B.C.) contexts at Sumbay (Neira Avendaño 1990). All obsidian samples from presumably Preceramic/Archaic sites in the Province of Caylloma (100%, N = 39) also source to Chivay (Burger, et al. 2000).

Even in the absence of permanent settlements or high intensity extraction, Chivay type obsidian had reached as far as Asana in the Moquegua valley by 7500 B.C.—the earliest documented case of its usage (Aldenderfer 1998; Burger, et al. 2000; Tripcevich 2007). Small quantities of obsidian at Asana suggest that “it was obtained via down-the line trading instead of direct procurement” (Aldenderfer 2008: 138; but see Tripcevich 2007: 290). Chivay type obsidian is also present in the Lake Titicaca Basin by 3500-3000 B.C. (Burger, et al. 2000). Obsidian fragments from preceramic strata at the Island of the Sun indicate that obsidian was being transported over a distance of 275 km, possibly by llama train and watercraft, or that “a relatively complex set of social and economic relationships” were in already place by the end of the Late Archaic to facilitate down-the-line trading (Stanish, et al. 2002: 451).

That said, circulation of obsidian from Chivay appears to have declined during the Late Archaic (5000-3300 B.C.) as “down-the-line networks may have become more segmentary and

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<sup>9</sup> Tripcevich (2007: 232) notes that the utility of hydration dating in the high altitude Andes is limited due to diurnal and seasonal temperature variations, casting doubt on Brook’s (1998) data.

isolated” (Tripcevich 2007: 814). Lower abundances of obsidian due to reduced mobility may actually have enhanced its social value, which would propel the dramatic expansion of obsidian trade in subsequent time periods (Tripcevich 2007). Despite its importance in emerging economic and symbolic economies, the Chivay/Cotallalli source never came under the control of a single polity or social group in prehistory, nor does it appear to have been “widely used by local populations despite abundant access only a few hours from their communities” (Tripcevich 2007: 672-673).

#### *Formative (3300 B.C. – A.D. 500)<sup>10</sup>*

The Formative period in Arequipa witnessed the establishment of permanent settlements in the absence of hierarchical organization, as well as the emergence of mixed economies combining high altitude pastoralism and valley bottom cultivation (Tripcevich 2007; Wernke 2011). During period of abundant rainfall, cultivation also extended to higher, sloping fields that were configured to control runoff (Treacy 1989; Wernke 2011: 127-129). In fact, Brooks (1998) argues that unirrigated bench terraces above 4,000 masl in the Río Japo Basin represent the earliest known example of terracing in the Andes, based on a radiocarbon date from terrace fill ( $4350 \pm 80$  B.P., 3327-2640 cal B.C.). Wernke (2003: 21), however, notes that terraces are notoriously difficult to date and that Brooks’ (1998) dates contradict well established regional chronologies which place the shift to agricultural sedentism around 1500 B.C.

Formative settlements are only firmly documented in the central valley, in the ecological zones where agriculture was most productive (*kichwa* and *suní*). For the lower valley, Mujica

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<sup>10</sup> Tripcevich (2007) groups “Terminal Archaic” with Formative since the social and economic changes typically associated with the latter, namely the establishment of an agro-pastoralist economy and incipient social differentiation, begin in the Terminal Archaic.

and De la Vera Cruz (2002: 154) cite evidence of an “incised ceramic” associated with the Formative period at the site of Ichircate near the modern town of Cabanaconde, although they could not define the Formative component due to overlying occupations.<sup>11</sup> In all, Wernke (2003) documented 21 settlements in the central valley, based on the presence of local undecorated ware (Chiquero) diagnostic to the period.<sup>12</sup> These settlements are generally small and dispersed, located on alluvial terraces and surrounding slopes, and lack evidence of corporate architecture or internal differentiation (Wernke 2011). However, large agricultural wall systems and extensive cultivation of valley bottom fields suggest a greater degree of coordination between households or corporate groups than previously thought (Wernke 2011).

While most sites are concentrated on the valley floor, the large agricultural settlement of Chiquero (YA-032) stands out for its size (3.88 ha), prominent location in the *suní* zone (3,600-3,900 masl), and abundant artifact yield, including projectile points, stone hoes, and the undecorated, utilitarian ceramic ware which derives its name from this site (Wernke 2011: 206-208). Given its intermediary location, as well as its proximity to road networks leading out of the valley, Wernke (2011: 208) suggests that it could have served as a “point of articulation between diverse zones of production at the regional level.” The largest lithic scatter documented by Wernke (2003) in the *puna* can be reached from Chiquero on foot within an hour.

Overall, there is evidence for occupational continuity between the Archaic and Formative at both open air and rock shelter sites in the *puna*, along with an increase in sites located proximal to bofedal grazing areas and water sources, reflecting the shifting economic base

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<sup>11</sup> Notably, Doutriaux (2004) failed to document any Formative sites in her survey area, leaving the nature of Formative period occupation in the lower valley unresolved.

<sup>12</sup> In the upper valley, excavation levels containing Chiquero ceramics date to  $1313 \pm 36$  B.P. (cal A.D. 675–863), “suggesting that this ceramic style persisted in use in the higher altitude regions of the Colca” (Tripcevich 2007: 577-578).

(Tripcevich 2007; Wernke 2011). In fact, the Chivay obsidian source overlooks ideal grazing area, and there is evidence that quarrying for higher quality, transparent obsidian becomes more intensive and regular during this period (Tripcevich 2007: 469, 591). Pastoralism and obsidian procurement would have been closely linked because of the utility of obsidian for shearing and butchering and the availability of cargo animals for distribution. The lack of large obsidian fragments immediately outside of the source area suggests to Tripcevich (2007) that large obsidian nodules were being extracted by non-locals and distributed via llama caravans.

Circulation of obsidian from the Chivay source markedly intensified beginning in the Terminal Archaic and continuing throughout the Formative Period, but was limited to the highlands and altiplano areas of the south-central Andes. Albeit in low quantities, Chivay obsidian makes up the majority of obsidian at sites in the north and south Lake Titicaca basin, and in particular at the Early-Middle Formative center of Qaluyu (87-100%, N = 38) and the Late Formative site of Pukara (70, N = 10) (Burger, et al. 2000; Tripcevich 2007). It also accounts for 97% of obsidian from Terminal Archaic contexts at the site of Jiskairumoko (Aldenderfer 2008). Aldenderfer (2008: 138) argues that obsidian and other non-utilitarian artifacts “may have been symbols of status and achievement by those who possessed them.”

Despite clear ties to the Lake Titicaca Basin, there are very few indications of influence in the opposite direction. Tripcevich (2007: 628-629) reports two sherds from the site of Taukamayo, near the modern town of Callalli, that share stylistic similarities with Qaluyu or early Pukara pottery. One classic “incised” Pukara sherd with a zoomorphic motif was also found by Wernke (2003) at the previously discussed site of Chiquero. As Wernke (2011) observes, the Formative period in the Colca Valley remains poorly understood and has only been



broadly sketched by regional survey; much more is known about extra-local ties than local social structures and their connection to broader inter-regional systems.

*Middle Horizon (A.D. 500 – 1000)*

During the Middle Horizon, Wari imperialism and Tiwanaku ideological hegemony swept across the central and southern Andes, yet there is scant evidence for the direct intervention of either colonial power in the Colca Valley. This is especially notable on two fronts: first, because of the clear Wari presence at sites located farther down the Colca-Majes-Camaná drainage (Jennings, et al. 2015; Tung 2012; Tung and Owen 2006), and second, because of the continued circulation of Chivay obsidian at Tiwanaku-affiliated sites (Burger, et al. 2000).

Nevertheless, Wari evidently had a stronger impact on material culture practices in the Colca Valley than did Tiwanaku. Middle Horizon ceramics in the Colca Valley reflect a Wari influence with regard to vessel form and multiple decorative elements, such as red slip, white paint decorations, and impressed dots and circles (Malpass 1986; Malpass and de la Vera Cruz Chávez 1988; Wernke 2003: 466-477). Some have even interpreted Wari-derived styles to indicate an imperial presence. De la Vera Cruz Chávez (1996) contends that the site of Achachiwa, near Cabanaconde is a Wari administrative center, but this has been roundly criticized because of clear local influences in domestic material culture and architectural layout at the site—not to mention the paucity of ceramics on which the designation is based (Doutriaux 2004; see also Schreiber 1992: 104).<sup>13</sup> Farther up valley in the district of Lari, Doutriaux (2004) interprets orthogonal architecture and restricted access in the central sector at Charasuta as

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<sup>13</sup> De la Vera Cruz (1989) found 32 fragments of Wari Qoscopa ceramics deposited in a floor offering in the only house structure he excavated. Interestingly, obsidian from Achachiwa was sourced to Alca and Quispisisa, in line with obsidian distribution patterns within the Wari sphere of influence (Brooks 1998; Tripcevich 2007: 261).

conceptually similar to Wari administrative complexes, but ceramic remains are notably lacking from the surface.<sup>14</sup>

At the very least, local populations in the lower valley, which were aggregating into larger villages during the Middle Horizon, likely “cultivated strong ties to the Wari polity” (Doutriaux 2004: 287). Whether or not it was truly a Wari administrative center, Achachiwa “dominates the local landscape, not only by its large size and central position, but also by its sheer visual impact on anyone approaching it across the plateau” (Doutriaux 2004: 203). This is in contrast to the central valley, “where settlements were limited to the scale of hamlets and villages during the Middle Horizon” (Wernke 2003: 83). Wernke’s (2003) survey area also lacks sites with internal differentiation, as seen in Cabanaconde and Lari. In short, the absence of Wari administrative structures in the central to upper reaches of the valley is undisputed, and the persistence of local Chiquero ceramics in the high *puna* may even suggest that Wari influence was indirect and primarily manifested in lower lying agricultural zones (Wernke 2003, Tripcevich 2007: 800).

Despite some measure of cultural ties between Colca Valley peoples and the Wari state, Chivay obsidian was not circulated in Wari economic networks. It is virtually absent from Wari sites in the heartland and hinterland, which were supplied primarily from the Alca and Quispisisa sources (Burger, et al. 2000). As previously mentioned, the Chivay source continues to account for the majority of obsidian in the Tiwanaku heartland, yet evidence for Tiwanaku control of obsidian near Chivay is lacking; not a single diagnostic Tiwanaku artifact has been found around the principal quarry in the *puna*, or at major sites in the *kichwa* and *suní* zones (Brooks 1998; Tripcevich 2007: 635). This unique scenario in which the people of the Colca Valley maintained

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<sup>14</sup> Overall, the lack of Middle Horizon ceramics even at sites that were not densely occupied in later periods “makes it difficult to fully characterize the Middle Horizon occupation in the valley” (Doutriaux 2004: 199).

longstanding but indirect economic ties to the altiplano, but also came under the cultural or political influence of Wari has led some researchers to suggest that the region served as a buffer zone between the Middle Horizon states (de la Vera Cruz Chávez 1989; Wernke 2013).

Regardless of the nature of Wari influence in the valley, there is clear evidence that agricultural infrastructure expanded at this time. Radiocarbon dates from three distinct terraces in Chijra tentatively place the initial phase of terrace construction at that site to the Middle Horizon (A.D. 500-1000) and are associated with local Middle Horizon ceramics (Malpass 1986). Early terrace agriculture was probably coterminous with the redirection of water to the Chijra area, via Chilacota, and the inferred use of dung fertilizers in these terraces (Sandor 1986: 266). The Middle Horizon antiquity for this agricultural terrace complex is supported by the presence of Wari-influenced ceramics within dated levels (Malpass 1986).<sup>15</sup> Brooks (1998) also argues that agricultural expansion, as well as population increase, occurred prior to the Late Intermediate Period, on the basis of climatological records which suggest a warm, wet period from A.D. 850-1050 (Grove and Switsur 1994; Thompson, et al. 1985)

Future research should investigate these developments in relationship to agricultural intensification within the Wari realm and clarify the nature of social and political organization during the Middle Horizon. With the present state of knowledge, we can confidently assert that the Middle Horizon was a period of population aggregation, at least in the lower valley, and agricultural innovation throughout the entire valley.

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<sup>15</sup> Radiocarbon dates from lower levels of the “upper” terraces support initial construction during the Middle Horizon, but this is problematic since associated material remains in terrace fill may pertain to earlier occupations (Malpass 1986: 157).

*Late Intermediate Period (A.D. 1000-1450)*

The key social and political patterns observed across the south-central Andes during the Late Intermediate Period (LIP)—namely, population expansion, social stratification, and inter-group conflict—are evident in the Colca Valley (Covey 2008).<sup>16</sup> Surplus production and population increase, trends beginning in the Middle Horizon, appear to have continued into the LIP, despite the onset of an extended dry period around A.D. 1200 (Engel, et al. 2014; Thompson, et al. 1985). At this time, there is a proliferation of settlements across the valley, varying in size, but characterized by shared “Collagua” architectural and ceramic styles (Wernke 2013). The large number and sizes of houses at single sites in the central valley provide an empirical basis for large population estimates (Wernke 2003). Growth in population during the LIP is also inferred from survey data in the upper and lower reaches of the valley (Doutriaux 2004: 226; Tripcevich 2007: 659).

Population expansion did not necessarily entail consolidation; in the lower part of the valley, the population was dispersed across numerous medium-sized settlements located strategically on hilltops or near bofedal grasslands. The prominent Middle Horizon settlements of Achachiwa and Charasuta were all but abandoned, supplanted by a more egalitarian site organization, which Doutriaux (2004) interprets as evidence of autonomous but cooperative communities during the LIP. Yet at the largest settlements, there is clear evidence of social differences based on house size and masonry type. At Kallimarka, a major LIP/LH site located on a prominent ridge southeast of Cabanaconde, more elaborate domestic structures are not restricted to any one sector of habitation. From this Doutriaux concludes that “the population,

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<sup>16</sup> A more wide-ranging summary of Late Intermediate Period conflict and cooperation will be presented in the context of theoretical models of mortuary practice in Chapter 3.

although economically stratified, was not divided into immutable, strictly hierarchical classes” (Doutriaux 2004: 242).<sup>17</sup>

A decentralized settlement pattern punctuated by large town-sized settlements also characterizes the survey area surrounding Yanque and Coporaque (Wernke 2003). Here the LIP settlement pattern is anchored by the large settlements of San Antonio/Chijra (CO-100), Uyu Uyu (YA-050), and Tunsa/Llactapampa (CO-153/163). Other major settlements include Uskallacta and Achomaniy, located on the opposite margin of the river, near Chivay and Achoma, respectively (Guerra Santander and Aquize Cáceres 1996; Shea 1986b). Similar to the major settlements near Cabanaconde, social stratification within these large settlements is indexed by structure size and the quality of house construction (Brooks 1998; Wernke 2003). In fact, Brooks (1998) distinguishes between “elite” and “working class” habitation sectors at Uskallacta, which is firmly LIP in chronology, suggesting that socio-economic differentiation in the valley preceded Inka intervention in local politics.<sup>18</sup> Dispersed among these major sites are a number of smaller agricultural hamlets and villages on the valley floor, clearly associated with the larger settlements from which they were visible. LIP occupation also encompassed multiple ecological tiers; in the *puna*, sites range from temporary encampments and rock shelters to small habitation sites that were utilized for pastoralist activities (Wernke 2013).

Many of the large sites in the central and upper valley were placed on natural hilltops and promontories, sometimes augmented by massive fortification walls, signaling a preoccupation with defense from violent conflict (Kohut 2016; Shea 1986a; Tripcevich 2007: 661; Wernke

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<sup>17</sup> Overall, material indicators of intra-site social differentiation in the lower valley are less clear due to poor preservation, yet Doutriaux (2004: 225) argues that “the existence of a stratified society during the LH suggests a similar trend during the LIP.”

<sup>18</sup> Only three Inka sherds were found at the entire site. The site also yielded the first secure radiocarbon date associated with Collagua ceramics from a domestic context. Charcoal from a hearth excavated from a test pit in one house in the “working class” sector (D) was dated to  $855 \pm 85$  B.P. (cal A.D. 1031-1379).

2013). A number of fortified refuges (*pukaras*) without permanent habitation also allude to persistent, if intermittent, inter-group conflict during the LIP.<sup>19</sup> Regionally, their distribution stretches from Block 3 of Tripcevich's survey, near Callalli, to the site of Pachamarca, near Maca (Neira Avendaño 2011 [1961]: 121-122; Tripcevich 2007: 661). Just south of the study area (Coporaque), a cluster of three fortified refuges is situated between Tunsa/Llactapampa and the smaller satellite communities of Kitaplaza and Llanka (Wernke 2013). Noting their equidistant location from nearby domestic sites, Wernke (2013: 94) argues that "the perceived threat was almost certainly external to all of these settlements collectively." How these hilltop forts communicated with one another on a broader regional scale, and the extent to which they were oriented toward internal versus external warfare, is the subject of ongoing research by Lauren Kohut (Kohut 2016).

Although warfare during the LIP is usually understood within a framework of resource competition, evidence for the impact of drought on agriculture is less clear in the Colca Valley (cf. Arkush 2008). To the contrary, agricultural production in the valley does not appear to have retracted with the onset of cooler and dryer conditions across the southern Andes (Brooks 1998; Denevan, et al. 1986; cf. Engel, et al. 2014; Thompson, et al. 1985). Brooks (1998) interprets the construction of the Huarancante Canal, which channeled snow melt from Huarancante volcano to the Rio Japo Basin, as evidence of Collagua resilience in the face of profound climate change. Cooperation between agriculturalists in the *kichwa* and *suní* zones and pastoralists in the *puna* may have also diversified resources and buffered local populations from ecological stress. Tripcevich (2007: 782) found decorated Collagua sherds throughout his upper valley survey

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<sup>19</sup> Defensive fortification are notably lacking in the survey area around Cabanaconde and Lari, which may suggest a more peaceful LIP occupation (Doutriaux 2004). However, two of the largest LIP occupations near Cabanaconde are located on hilltops with excellent viewsheds and could be considered "defendable" (Doutriaux 2004: 243).

area, “underscoring the close links between Collagua polity in the Colca valley, and their expanding herding sector on the adjacent puna.” The presence of circular houses in the high altitude *puna* and their association with corrals further suggest the consolidation of a pastoralist identity, which would come to define the Collaguas into the colonial period (Wernke 2003; Wernke 2013).

Pastoralist activities likely involved the exchange and circulation of obsidian, but without intensive quarrying or strict regulation of the source area. Few diagnostic LIP sherds were found in the Maymeja, the primary quarrying area, or on the road leading to the quarry pit (Tripcevich 2007: 637). However, fourteen Colla style sherds from the altiplano region are found in the area about 15 km southeast of the Maymeja, which encompasses “a natural bottleneck for economic traffic moving between the Colca and the Titicaca Basin” (Tripcevich 2007: 329). Along with the almost exclusive presence of Chivay obsidian at Lake Titicaca Basin sites, this provides an additional line of material evidence for the persistence of a Chivay-Titicaca exchange sphere, even as obsidian circulation declined in intensity (Burger, et al. 2000; Tripcevich 2007).

By all indications, the LIP was a period of dynamic cultural, economic, and technological innovation in the Colca Valley. Major hydraulic works, inter-zonal resource exploitation, and the construction of hilltop refuges point to productive, cooperative, and heterarchical relationships between groups in the valley, even in the face of growing class differences and conflict with external forces or one another. To date, these major developments have been primarily viewed from the bird’s-eye perspective of archaeological survey data and thus largely lack chronological resolution. What is needed is a finer-grained account of the timing and catalysts of social and political changes in the LIP and their impacts on the lived experiences of the Colca Valley’s inhabitants. Bioarchaeological data—until now virtually absent from syntheses of Colca Valley

prehistory—can provide the connective tissue that links individual practice, community politics, and the large-scale processes of conflict and cooperation that have come to define the LIP, from economic diversification to warfare, and ultimately, Inka imperial conquest.

*Late Horizon (A.D. 1450 – 1532)*

Understanding the timing and nature of the transition from autonomous rule to Inka control of the valley is made difficult not only by the lack of well-dated domestic contexts, but also the fact that most sites include both LIP and Late Horizon (LH) components. In practical terms, the “Inka” period in the Colca Valley is indicated by the presence of Collagua-Inka ceramics, Inka architectural forms, and in a few cases, Inka cut stonework. The start of imperial expansion into the region is not firmly established by radiometric dates, but generally placed around A.D. 1450, following Rowe’s (1944) chronology. It is reasonable to assume that Inka influence on Collagua society and material culture was a more gradual process, in which “alliances and hegemonic control were extended beyond the heartland region prior to the full implementation of direct control” (Bauer 2004: 88; Doutriaux 2004). In fact, Chapter 8 of this dissertation integrates multiple lines of evidence—including new radiocarbon dates—to propose a model of elite interaction and encroaching influence extending back into the 14<sup>th</sup> century.

Although the onset of Inka rule remains to be resolved, the ultimate effect of Inka governance on the social, political, and economic structures of the valley is clearly evidenced in the site organization and land tenure patterns documented by recent large-scale projects (Doutriaux 2004; Wernke 2003). The LH settlement pattern is largely continuous from the preceding LIP, although the greater density of Collagua-Inka ceramics, relative to earlier styles, suggests continued population growth and intensified site occupation during the Late Horizon.



The local population became increasingly centralized at large settlements, elevating particular sites in the settlement hierarchy and transforming what was a predominantly heterarchical settlement structure during the LIP.

These top-tier sites are located in upper, middle, and lower sections of the valley, yet no one “administrative site” clearly outranks the others in terms of architectural investment or size, suggesting that imperial control was grafted onto preexisting intra-valley ethnic and social divisions. In the upper valley and middle valley, administrative centers were established at Yanque and Lari, relegating former LIP population centers to second-tier settlements. On the other hand, the two main LIP population centers in the lower valley, Antisana and Kallimarka, maintained roughly equal status during the LH (Doutriaux 2004). Notably, Kallimarka exhibits public architecture in the Inka canon including an *ushnu* platform and two *kallankas*, long rectangular structures with multiple doorways. These “great halls,” and their associated plazas, are typically associated with feasting and public ritual. In the Colca Valley, they are not restricted to administrative centers, but are also present at second-tier sites, such as Uyu Uyu and San Antonio/Chijra, evidence of the important role these sites continued to play in political ceremony and the legitimization of Inka authority (Wernke 2013).

Ethnohistoric evidence and settlement survey suggest the Collagua political economy crystalized under Inka rule. Inka intensified maize production in the *kichwa* zone and expanded pastoralist activities in the *puna* (Doutriaux 2004; Wernke 2013). The importance of maize production in the Colca Valley is underscored by its reputation as a “bread basket” of the Inka Empire (Malaga 1977, in Denevan 1986: 21), although Doutriaux (2004: 263-264) notes the absence of “large-scale storage features” in her survey area. Regardless, she suggests that cultivation expanded to upper terraces in the area surrounding Cabanaconde during the LH. New

settlements on the outskirts of Lari may also reflect intensification of agricultural production into “areas that had not been exploited previously” (Doutriaux 2004: 277). Malpass (1986) also documents a second phase of terrace construction at Chijra, but primarily concentrated on lower slopes, which would be better suited for maize cultivation. These lower terraces, associated with Inka ceramics, exhibit a segmented and orderly organization that is “highly reminiscent of Inca terracing elsewhere in the Andes” (Malpass 1986: 162). It is worth noting that the radiocarbon date ( $610 \pm 60$  B.P) obtained from the soil of a lower level terrace provides a 2-sigma range of cal A.D. 1297-1442, with the overwhelming majority of the probability distribution falling before the traditional A.D. 1450 date for the LH.

Even in the upper reaches of the valley, the site of Callilli Antiguo, a predominantly LH settlement, shows evidence of agricultural production along the natural terraces to the south of the Rio Llapa, near its juncture with the Colca River (Tripcevich 2007). Outside of the limits of maize cultivation, this area “may have been involved in dry land production of high altitude seed-plants,” such as quinoa (*Chenopodium*) (Tripcevich 2007: 668). Yet, the most salient feature of high altitude settlement during the LH is the marked increase in the total number of sites in this ecological zone (Wernke 2003). In the high plains surrounding Yanque and Coporaque, new settlements were located near water management features, such as reservoirs and canals, that could be harnessed to increase pasturage for large herds of camelids (Wernke 2013: 151). Tripcevich (2007) similarly notes a strong Collagua-Inka presence in the obsidian source area, which “may be a reflection of the increased investment in water control projects and expanded herding” (Tripcevich 2007: 783). Notably, an increase in obsidian circulation did not accompany these other economic investments.

Clearly, the Inka leveraged the region's economic strengths, intensifying agriculture for surplus production and expanding camelid husbandry, presumably to meet demand for the beautiful camelid fiber textiles that were so valuable in Inka society (Wernke 2003). As Wernke (2013) argues, the Inka impact on the Colca Valley political economy was not accomplished by fiat but improvised through preexisting social and political structures (see also Wernke 2006). A more complete understanding of Inka social order requires careful interlocution between ethnohistoric and archaeological sources and their interpretation in light of Andean models of ethnicity, kinship, and economic complementarity; this task will be carried out in the ultimate section of the chapter.

#### Mortuary Diversity in the Colca Valley

Previous archaeological survey reveals a diversity of mortuary practices in the Colca Valley, although the social and chronological significance of this variation is only beginning to be understood. In conjunction with the archaeological data on settlement organization and prehistoric agriculture, mortuary evidence provides a window into processes of socio-structural differentiation, as well as the emergence of ideational concepts concerning ancestors and their relationship to the living. Three general classes of mortuary features have been identified in the valley: agro-mortuary complexes, simple cist burials, and above-ground funerary structures (*chullpas*). General characteristics and temporal associations of each type are presented in this section, in order to locate Yuraq Qaqa (CO-098) and Sahuara (CO-118) upon the broader mortuary landscape.

Agro-mortuary complexes provide the earliest evidence of formal mortuary rituals in the valley. Originating in the Formative period, these irregularly organized wall complexes not only

demarcated agricultural fields, but also contained funerary cists built into a coarse rampart of rubble and earth stretching between single or double-course field walls (Wernke 2011). Agro-mortuary cist tombs are circular and ovoid in form, range from 0.5-1.0 m in diameter, and probably housed multiple interments. Chiquero ceramics from these tombs place their initial appearance in the Formative Period, but their use may have continued through the entire prehispanic sequence. Test excavations of two cists by Doutriaux (2004: 176-177) confirm a Middle Horizon component and show that both adults and children were buried in these structures, along with modest grave goods (see also de la Vera Cruz Chávez 1988: 45-46). It is also possible that some cists functioned as agricultural storage units (Wernke 2003; 2011). The intimate association between burials and agricultural fields calls to mind widely prevalent Andean ontological concepts that link ancestor veneration with agricultural fertility (Nielsen 2008; Salomon 1995).

Similar in size and profile to agro-mortuary cist tombs, rock-lined subterranean pit burials are found throughout domestic settlements or on the hillsides surrounding them (Doutriaux 2004; Wernke and Guerra Santander 2010). They are generally circular or ovoid in form, measure between 0.50 to 1.25 m in diameter and up to 1.0 m in depth, and feature a stone-lined collar and large slab capstone (Doutriaux 2004; Wernke 2013).<sup>20</sup> In the Achoma district, Shea (1986a) describes “kidney-shaped” cist burials, twice as long as wide, which may have accommodated skeletons in a prone position. Unfortunately, subterranean tombs in both the lower and upper valley are generally found looted, with only very fragmentary skeletal material, and so any inference about body treatment is necessarily suppositional. Moreover, collared tombs are difficult to qualitatively distinguish from under-ground storage units, or *qolcas*. At the very least,

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<sup>20</sup> At the site of Kuchki (CA-06), “small above-ground cupolas made of cobbles” were used in lieu of stone caps to seal and mark subterranean stone-line tombs (Doutriaux 2004: 259, citing de la Vera Cruz 1988: 99-101).

we can assume that subterranean tombs represent lower status burials relative to the more elaborately constructed *chullpas* with which they overlap chronologically (Doutriaux 2004; Shea 1986a; Wernke 2013).<sup>21</sup> Differential investment in above-ground versus subterranean tomb construction at the same domestic sites further suggests that treatment of the dead reinforced social stratification among the living during the late prehispanic period.

Ever since Neira's (2011 [1961]) foundational survey, *chullpas* have stood out as a key feature of the archaeological landscape.<sup>22</sup> In the Colca Valley and elsewhere, the term *chullpa* has been liberally applied to any above-ground structure or open sepulcher that housed one or more mummies and enabled continued interaction with the living and the dead. Within this general category, *chullpas* vary in size, shape, masonry, decorative elements, and placement on the landscape, although most feature a small, east-facing doorway, no more than 0.5-1.0 m high, through which mummies were accessed and feted. Doutriaux (2004) provides a basic typology of mortuary structures in the valley, classifying *chullpas* as either free-standing, inserted, or abutted (Figure 2.5). All types are found throughout the valley. Whether or not different *chullpa* types reflect meaningful chronological or social differences is not well understood, but collectively, they represent a pan-ethnic mortuary tradition common to both the Collaguas and the Cabanas.

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<sup>21</sup> To my knowledge, intact collared cist tombs have yet to be excavated in the Colca Valley. A lack of data on the burial practices and bioarchaeological profiles of the general populace (compared to the presumably elite individuals buried in above-ground structures) limits our understanding of social diversity and inequality in the prehispanic period.

<sup>22</sup> Neira (2011 [1961]) describes numerous *chullpas* and provides measurements of the length, width, and height of the most notable ones. Interestingly, the necropolis of Yuraq Qaqa is not mentioned in his summary of archaeological ruins in the district of Coporaque.



Figure 2.5. Free-standing *chullpa* (left), inserted *chullpa* (center), and abutted *chullpas* (right).

Free-standing *chullpas* are found in a variety of spatial contexts, but generally located in prominent places on the landscape, such as hilltops and natural promontories, where “they can see and be seen from a distance” (Doutriaux 2004: 181). *Chullpas* were usually built along the periphery of habitation, in isolation or grouped in small clusters (Doutriaux 2004; Neira Avendaño 2011 [1961]; Shea 1986a; Wernke 2013). Free-standing *chullpas* are remarkably diverse in their layout, size, and construction. They may be rectangular, circular, or horse-shoe shaped (i.e., rounded with one flat side), with one or two stories, varying in total interior area from 0.7 m<sup>2</sup> to 2.5 m<sup>2</sup> (Doutriaux 2004).<sup>23</sup> Most feature corbelled-arch or slab roof ceilings.<sup>24</sup> As with Collagua houses, the quality of *chullpa* masonry ranges from coarse, irregular stonework to shaped tabular stone. The latter is exemplified by an especially elaborate burial tower at the site of Uskallacta, cylindrical in shape and architecturally reminiscent of *chullpas* in the altiplano (Brooks 1998; Guerra Santander and Aquize Cáceres 1996). Most *chullpas*, however, are rustic in style.

<sup>23</sup> Shea (1986a) describes “beehive-shaped” *chullpas* up to 8-10 m in diameter in the district of Achoma, although a *chullpa* of that size is the exception to the norm.

<sup>24</sup> According to Neira (2011 [1961]), the gigantic rectangular *chullpas* at the Necropolis of San Miguel (District of Huambo) have gabled roofs, a key architectural element of Collagua houses.

*Chullpas* built within rock shelters and caves (‘inserted’ *chullpas*) or against rock escarpments (‘abutted’ *chullpas*) represent a continuum of above-ground mortuary practices that share a similar aesthetic of integrating mortuary architecture with natural features on the landscape, such as boulders and rocky outcrops. The category of inserted *chullpa* in Doutriaux’s (2004) typology includes cave burials (*machays*) with little to no architectural modification beyond the use of rock and mortar to plug natural crevices. Other cave burials, such as those documented at the site of Sahuara (CO-118) involved more notable architectural modification, such as a single wall (with doorway) used to delimit the natural space, as well as internal walls, perpendicular to the façade, that divided the rock shelter into separate chambers. Doutriaux (2004: 183) provides an apt description of these rudimentary walls, “made of irregular fieldstones slapped together with enormous quantities of a light colored mud mortar that drips and bulges between them, giving the impression of a quick, careless job with little concern for durability.” And yet, these cool, dry recesses allowed for durability of another kind—that of the mummified body—by offering natural refrigeration and protection from the elements.



Figure 2.6. Abutted *chullpas* at Yuraq Qaqa (CO-098).

Abutted *chullpas* are the most elaborate expression of this mortuary tradition aimed at preserving the dead body and emplacing it upon the built landscape. Abutted *chullpas* typically involve semi-circular or rectangular structures that appropriate a rock face as a fourth wall. They are sometimes built in agglutinated clusters of vertically and horizontally stacked chambers, forming a beehive-like structure (Figure 2.6). Recurring architectural elements, found also in freestanding *chullpas*, include corbelled-arch roofs and small doorways oriented to the east. Abutted *chullpas* have been documented throughout the Arequipa region, in Cabanaconde (Doutraix 2004), the Cotahuasi Valley (Jennings and Yépez Alvarez 2009), and the area around Mount Coropuna (Sobczyk 2000). Based on associated ceramics and radiocarbon dates, the construction and use of abutted *chullpas* stretches from the terminal Middle Horizon through the Late Horizon (A.D. 900-1532).



In the Colca Valley, the masonry of abutted *chullpas* pales in comparison to the more finely built *chullpas* of well-worked stone documented by Sobczyk (2000). Nevertheless, these cliff-face dwellings for the dead stand out for their prominent position on the landscape. Their visual salience would have been enhanced by a decorative finish of light-colored plaster and bright red ochre, remnants of which are still found on some buildings (Doutriaux 2004; Velasco 2014; Wernke 2013; see Figure 2.7).<sup>25</sup> That this mortuary tradition is not restricted to any one area of the valley suggests that it crosscut social boundaries based on ethnicity or subsistence practice. Fewer in number than inserted *chullpas*, abutted *chullpas* were likely reserved for elite individuals (Doutriaux 2004; Wernke 2013). Notable sites featuring this tomb type include the site of Kallimarka (CA-18) in the lower valley, Yuraq Qaqa (CO-098) in the central valley, and Laiqa Laiqa in the upper valley, near Tuti.<sup>26</sup> Yuraq Qaqa (CO-098) represents the most elaborate cemetery of abutted *chullpas* (Figure 2.6). The site is described in greater detail in Chapter 4.



Figure 2.7. Remnants of plaster and paint on above-ground funerary structures at Yuraq Qaqa (left) and Sahuara (right).

<sup>25</sup> The freestanding, rectangular *chullpas* at the necropolises of San Miguel and Kupuraime were also covered in stucco and red paint (Neira 2011 [1961]: 133-135).

<sup>26</sup> Doutriaux (2004: 235) declares that the most elaborate *chullpa* at CA-18 “dates unambiguously to the Late Horizon.”

Still other unique mortuary constructions exist in the Colca Valley that defy easy categorization or interpretation. Tripcevich (2007: 655-656) describes a walled-in cave burial in the Huañatira Valley that also includes a circular mortuary feature inside, just over 3 m in diameter and 0.5 m in depth. The feature bears resemblance to the large slab-cist tombs found in the western Lake Titicaca Basin (Velasco and Arkush 2011). Circular abutted *chullpas* have also been located in the upper valley, representing a distinct architectural variant of the typical rectangular layout (L. Kohut, personal communication).

Even excluding these outliers, the range of burial treatments available for the dead was considerable, differing widely in size, construction technique, relative frequency, and placement on the landscape. If all *chullpa* types and subterranean stone-lined tombs were roughly contemporaneous, then it is possible that mortuary practices reinforced “a parallel two- or three-tiered class division of society during the LIP and LH” (Doutriaux 2004: 189). Because the human skeletal remains analyzed herein derive from both abutted and inserted *chullpas*, the relationship between mortuary variability and social diversity will be directly examined in the present study. Interpretation of the clues written in bones will benefit from a rich ethnohistoric record that provides crucial insights into the kinship structures that undoubtedly shaped mortuary practices in the past.

#### Ethnicity, Ayllu, and Social Differentiation in the Late Prehispanic Period: Synthesizing Archaeological, Ethnohistorical, and Demographic Data

Colonial accounts of the local population point toward remarkable social and ethnic diversity in the region during (and even before) Inka rule. Wernke’s (2003; 2007b; 2013)

research demonstrates the potential of a critical integration of ethnohistoric, archaeological, and spatial data for reconstructing the land-use patterns of *ayllu* kin groups. For this study, the ethnohistoric record can be used to hypothesize expected bioarchaeological correlates of known structures of social organization, differentiation, and inequality, which continued to operate, albeit transformed, during the Spanish colonial era. In this section, I synthesize archaeological and ethnohistoric data on these social structures, ranging from macro-level ethnic polities to local kinship units, to build a culturally-specific foundation for a discussion of the politics of death in the next chapter.

Our starting point is the account of the valley’s inhabitants written by Juan Ulloa de Mogollón, Corregidor of the Province of Los Collaguas from 1583-1589. Ulloa tells us that the province was home to “two kinds of people, different in language and dress”—the Collaguas and the Cabanas. The Collaguas predominantly spoke Aymara, while the Cabanas spoke a “corrupt and very uncouth” version of Quechua (Ulloa Mogollon 1965 [1586], my translation).<sup>27</sup> Ulloa recounts the peculiar head shaping rituals of these groups, which by the time of his writing had been outlawed by the Toledan reforms. The Collaguas tightly bound the heads of their infants to make them long and narrow, while the Cabanas used boards to make them squat and wide. These head shapes were accentuated by unique head gear and said to emulate the form of each group’s principal *huaca*—the volcano Collaguata and the snow-capped peaks of Hualca Hualca—from which they respectively originated. Ulloa’s account has since been cited as a classic example of ethnic identity marking in the Andes (Blom 2005; Tiesler 2014).<sup>28</sup>

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<sup>27</sup> Neira (2011 [1961]: 152-153) posits that the spread of Quechua in the lower Colca Valley was either the result of a “more radical Inka influence” or due to the resettlement of Quechua-speaking *mitimaes* in the area

<sup>28</sup> Ethnic diversity in the Colca Valley probably extended beyond the dichotomy of Collaguas/Cabanas. Ulloa tells us that peoples of some Collagua towns, such as Pinchollo, Calo, and Tapay, spoke distinct languages from one another, even though Aymara was the dominant tongue. It is also likely that, ethnic colonists (*mitmaquna*) from outlying regions, such as Canas and Chumbivilcas, resided in the Colca Valley late in prehistory (see Wernke 2013: 248, fn. 19).

Distinct mythic origins are also a hallmark of ethnic differentiation in the Andes. Ulloa describes the Collaguas as an outsider group that descended into the region from Collaguata, purportedly located to the north in the province of Velille between Cusco and Arequipa, conquering and displacing the valley's native population.<sup>29</sup> Some scholars have hypothesized that the Collaguas actually originated in the altiplano region to the east. This alternative account characterizes the Collaguas as a cultural offshoot of the Colla (Qolla) or Lupaqa ethnic kingdoms that inhabited the western Lake Titicaca Basin late in prehistory (Brooks 1998; Neira Avendaño 2011 [1961]; Pease G.Y. 1977b; Riva Agüero 1953). Neira (2011 [1961]) suggests that Aymara-speaking agro-pastoralists, facing drought in their homeland, migrated to the Colca Valley in search of fertile lands. Brooks (1998: 372) favors a scenario of small-scale migration and assimilation, in which the local population “embraced and assimilated occasional families that migrated to the Colca Valley from the altiplano.” Both accounts border on the fanciful and reflect an idyllic vision of LIP diaspora with little rigorous evidence to support it.

The hypothesis of a cultural connection between the Collaguas and Lake Titicaca Basin ethnic polities, however, is not without empirical basis. Both regions shared linguistic affinities (Aymara), economic ties through the trade of obsidian, and other similarities in material culture. Brooks (1998: 323) and Malpass (1986: 164-165) point to several ceramic design motifs common to Collagua and altiplano pottery traditions as evidence of their cultural affinity. Wernke (2013: 129) also suggests that circular houses, found only at high altitude pastoralist settlements in the Colca Valley, “could reflect longstanding ties with agro-pastoralist and herding peoples to the east, since circular domestic structures are common to the Qollas, Lupaqas, and other Aymara-speaking peoples of the Titicaca basin and Altiplano.” Furthermore,

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<sup>29</sup> According to Ulloa, the Cabanas also descended into the valley and displaced the autochthonous inhabitants, but prior to the arrival of the Collaguas.

cultural groups in both regions shared similar practices of mummification and burial, using woven, cocoon-like basketry to encase bodies placed in above-ground caves (*machays*) and sepulchers (*chullpas*) (de La Vega, et al. 2005; Wernke 2013: 142-144). Finally, the elongated form of cranial vault modification attributed to the Collaguas is akin to variants of the annular style documented in the altiplano (D. Blom, personal communication). Neira (2011 [1961]: 150-151) points out that the native term for the “brimless hat” (*chucos*) which accentuated the Collagua head shape is the same one the chronicler Cieza de León reports for the Colla (Cieza de León 1945: 256; see also Tiesler 2014: Ch. 5).

Of course, shared cultural similarities could be due to long-term contact rather than direct migration or biological descent. As Tripcevich (2007) shows, Lake Titicaca Basin groups acquired obsidian without direct control of the source, and other forms of material culture may have spread with the circulation of itinerant llama caravans, rather than having been imported by permanent settlers. The challenge of associating material culture with ethnic identity in the Andes also undermines the hypothesis that the Collaguas originated in the altiplano region (Stovel 2013). In fact, the Collaguas and Cabanas share the same ceramic and mortuary traditions, despite other meaningful differences in dress, language, and cranial modification. Thus, the available data cannot conclusively say if the Collaguas migrated into the valley from the region around Velille to the north or from the Lake Titicaca Basin to the east.

Regardless of its historicity, the Collagua origin myth evokes a broader narrative, repeated throughout Andean origin stories, of a conquering group (*llacua*) that enters into a relationship of complementarity with the autochthonous inhabitants (*huari*) of a valley or region (Gose 2008). The intrusive group, typically associated with pastoralist activities at high altitudes, literally and figuratively occupies an “upper realm” relative to *huari* agriculturalists. The dualism

between “upper” and “lower” pastoralist and agriculturalist economies mirrors a similar division between the Collaguas and Cabanas, who were respectively oriented toward camelid herding and maize agriculture (Pease G.Y. 1977b). As the higher ranking group in the *huari-llacua* dyad, the Collaguas may have been politically superordinate to the Cabanas, although settlement pattern data suggest the Cabanas were a separate polity, centered around Cabanaconde and independently administered by the Inka Empire (Doutriaux 2004; see Wernke 2013: 246, fn. 7).

Dual organization of ranked groups permeates other levels of Collagua society. In the Spanish colonial administration, the Collaguas were divided into two political subunits predicated on kinship ties, Yanquecollaguas and Laricollaguas. The higher-ranking Yanquecollaguas were centered on Yanque, which was (not coincidentally) the seat of Inka control in the upper valley, while the lower-ranking Laricollaguas occupied the area down valley, intermediate to Yanquecollaguas and Cabanaconde. The relationship between these two groups was expressed through an idiom of kinship; as Ulloa explains, *Lare* means “uncle” or “relative,” and both groups claimed the same origin point. Yanquecollaguas and Laricollaguas were each composed of upper and lower moieties, *Hanansaya* and *Urinsaya*, which governed political, ritual, and social activities, including the management of water sources (Gelles 1995; Treacy 1989). A hallmark of Inka social organization, the *Hanansaya/Urinsaya* division would have been culturally legible to a local population whose autochthonous system of organization was based on Aymara principles of dualism (Platt 1986; Wernke 2013).

Inka rule also embedded a tripartite structure of kinship within the system of dual organization. Each moiety was conceptually organized into three “macro-level” *ayllus*, consisting of 300 households each and named in descending order of rank as *Collana*, *Pahana* and *Cayao*. Each macro-level *ayllu* was further subdivided into groups of 100 household called

*patacas*, which repeated the tripartite naming convention to express high, middle, and low status within the macro-*ayllu*. For example, *Collana Pahana Pataca* was the middle-ranking *pataca* of the highest-ranking *ayllu*. The system of rank mediated political relationships between the heads of each *pataca ayllu* within the nested dyadic and tripartite structure, with the head of *Collana Pataca* of *Hanansaya* as paramount lord of the Collaguas, and his *Urinsaya* counterpart as secondary lord (Cock Carrasco 1977). The census records (*visitas*) of Yanquecollaguas *Urinsaya* testify to the endurance of these organizational principles into the post-conquest period, despite the fact that *ayllu* structures had been partly fragmented by resettlement practices, forced labor regimes, and population decline (Wernke 2013).

Although each of nine *pataca*-level *ayllus* theoretically occur in both the *Hanansaya* and *Urinsaya* moieties, tripartite social organization was unevenly implemented in the upper Colca Valley under Inka imperialism. The upper moiety of Yanquecollaguas (*Hanansaya*) actually retained an autochthonous subdivision into conceptual “right” and “left” side *ayllus*; in contrast, *Urinsaya* followed the tripartite scheme outlined above. As Wernke (2006b; 2007b; 2013) argues, *ayllu* onomastics point toward an Inkaic social engineering program that differentially affected *ayllus* according to rank. This was not merely a symbolic accommodation, but one that had implications for land tenure practices in the valley. By spatializing records of *ayllu* landholdings with reference to toponyms in the colonial *visitas*, Wernke (2007b; 2013) shows that *Hanansaya* landholdings fall to the “right” (west) and “left” (east) of a key hydrological boundary in the upper valley, mirroring the autochthonous division between right and left-side *ayllus*. On the other hand, *Urinsaya* landholdings are scattered across both sides of the Chillihuitira, suggesting that *ayllu* restructuring by the Inka directly shaped agricultural practices

and may have involved land redistribution.<sup>30</sup> Although *Hanansaya* maintained a privileged status relative to *Urinsaya*, it is important to note that landholdings of these moieties were not territorially discrete; by extension, it can be assumed that members of each moiety lived alongside one another at the same domestic settlements (Wernke 2013).

*Ayllu* status structured not only the horizontal separation of landholdings but also vertical differentiation based on total landholding area and control of diverse ecological resources. Wernke (2013) plots total landholding area by household based on *visita* declarations to illustrate the stark inequalities in land wealth between and within communities. Not surprisingly, the greatest concentration of wealth is observed at Yanque, the seat of political power during the Inka period, where the median number of landholdings per household is 3.0 *topos*, or land plots, and in fact, the families of elites and *kurakas* held 3-5 times that amount (Wernke 2013: 234-235, Fig. 6.4). Higher-ranking *ayllus* in Yanquecollaguas and Laricollaguas also maintained herding outposts in the upper reaches of the valley, as well as maize production enclaves in lower-lying territories as far away as Arequipa (Galdós Rodríguez 1987; Guillet 1992; Wernke 2013).

On face value, this settlement pattern follows an Andean model of verticality, where *ayllu* members are dispersed across ecological zones in order to diversify their resource base (Murra 1975). But as Wernke (2013) and others convincingly argue, access of supra-local resources was not an economic adaptation to a marginal environment, so much as political strategy “tied to the political obligations of highland elites” (Van Buren 1996: 347). *Ayllu* rank in general, and the status of paramount and minor lords in particular, were parlayed into preferential access to maize, camelid wool, and artisanal goods that circulated within a prestige economy (Cock

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<sup>30</sup> Shea (1986b) also argues that the Inka influence was strongest at *Urinsaya* villages in Achoma, which were located in the agriculturally productive areas favoring maize cultivation.



Carrasco 1977; Wernke 2013). This strategy resulted in the creation of multi-ethnic settlements (*llactas*) where groups living in close proximity to one another were neither closely related nor equal in wealth status (Martínez C. 1998).

In conclusion, archaeological and ethnohistoric data from the Colca Valley allow researchers to retrodict certain aspects of LIP and LH social organization by integrating observed ethnic and social differences during the colonial period with archaeological evidence of social and economic inequality in the prehispanic era. Clearly, there existed social heterogeneity at multiple overlapping scales, from valley-wide ethnic differentiation to intra-community status differences, the latter indexed by house size and land tenure patterns. Economic strategies, respectively oriented toward agriculture and pastoralism, intersected nested levels of *ayllu* and ethnic identity, but also were intricately bundled with local ecology, language, place of origin, and cranial modification (Mannheim, et al. in press).

Finally, *ayllu* affiliation structured differences predicated on lineage, status, and resource access, but it also provided the basis for mutual cooperation and economic complementarity at higher levels of inclusiveness (Wernke 2013). Did it also mediate burial politics, and if so, at which level of integration: lineage/household, moiety, or macro (ethnic) *ayllu*? Although the ethnohistoric record for the Colca Valley is silent on the region's mortuary practices, ubiquitous as they are across the landscape, bioarchaeology provides a useful framework for linking biocultural identity of ancient skeletons with broader models of social and ethnic diversity in the late prehispanic Andes.

## CHAPTER 3

### CONFLICT, COOPERATION, AND MORTUARY POLITICS: A BIOARCHAEOLOGICAL APPROACH

#### Introduction

Through the manipulation, commemoration, and transformation of the dead body, mortuary practices constitute a symbolic arena for the performance and enactment of social order (Chesson 2001; Metcalf and Huntington 1991; Parker Pearson 1982; Salomon 1995). The spatial, social, and ontological positioning of the dead vis-à-vis the living can work to maintain, override, or reformulate divisions between residential groupings (Joyce 1999), social classes (Bennett 1994; Morris 1991), resource-holding collectives (Chapman 1995), political or kin-based lineages (Dillehay 1995a), and ethnic groups (Beck 1995). Because mortuary practices can intervene directly in the formation of state sovereignty or community autonomy—with the potential to transform relationships of power among the living and the dead—they are inherently political and often contested. Thus, close analysis of mortuary monuments and the social individuals entombed within offers a glimpse into the political and material practices by which the boundaries between living and dead, kin and non-kin, “us” and “them” were negotiated during times of profound social and political transformation.

This study builds upon decades of research on mortuary practices and their relationship to social structure, individual agency, collective memory, and political transformation to contextualize and problematize our understanding of the *chullpa* phenomenon of the Late Intermediate Period (LIP, A.D. 1000-1450). In the Andes, the proliferation of above-ground sepulchers is thought to have intensified territorial and exclusionary social practices of land-holding, kin-based collectives distributed across a politically fragmented landscape (Isbell 1997;

Mantha 2009). This portrayal invokes classic structural-functional hypotheses in which mortuary monumentality emerges as a tactic for demarcating and legitimizing resource rights, especially in the context of resource competition, which have been presented as a central motivating factor behind social conflict during the Late Intermediate Period (Arkush 2008; Torres-Rouff and Costa Junqueira 2006). Yet, whether burial towers and caves actually reified social boundaries between corporate groups, or alternatively promoted alliance and exchange among different political or economic factions, remains unexplored through the bioarchaeological analysis of the individuals buried therein.

In this chapter, I review processual and post-processual developments in mortuary theory to synthesize two competing models of mortuary politics, which underlie the dominant interpretations of open sepulchers in the Andes. These models are then explored in light of a bioarchaeological approach, which offers methodological and conceptual tools for moving between multiple scales of analysis, from the human body to the body politic. This approach weaves together independent lines of evidence to elucidate how processes of social integration, differentiation, and transformation are both embodied in daily practice and instantiated through the rituals surrounding death. In the final section, hypotheses and expected bioarchaeological correlates for each theoretical model are presented and alternative hypotheses considered.

## Structure and Agency in Mortuary Theory

### *Processual Approaches*

The comparative and systematic study of mortuary practices from an archaeological perspective emerges at the dawn of New Archaeology (Rakita, et al. 2005).<sup>31</sup> Combating

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<sup>31</sup> For a comprehensive summary of the history of mortuary studies in archaeology, the reader is referred to the introductory chapter of Rakita et al. 2005. Carr (1995) also lays out the intellectual genealogy mortuary studies in

historical-distributional approaches, the processual paradigm endeavored to explain mortuary behavior as the product of cross-cultural social processes rather than cultural diffusion (Binford 1971; Brown 1971; Chapman 1981). Binford (1971) challenges early anthropological works (e.g., Kroeber 1927) that portrayed mortuary behavior as inherently “unstable” and independent from other “core” social variables, hypothesizing a stable structural relationship between modes of interment and the organizational features of a society. From this basic observation flows a number of inferences that align closely with the tenets of New Archaeology; first, that mortuary practices form a discrete cultural unit in a system of interrelated parts. Second, that they systematically adapt to different cultural circumstances, such as the need to regulate inter-generational property transmission (Saxe 1970).

The structural-functionalism of the Saxe-Binford program, as it is commonly called, contains implicit theories about the relationship between social identity and mortuary practice. The processualist school treats social identity as a composite of variables (namely, age, sex and status) that, to a degree, determine burial type and location. In particular, the social rank of an individual should correlate with grave location, form, furnishings, and overall energy investment (Binford 1971: 21; Saxe 1970; Tainter 1978). Under this premise, the deceased’s mortuary arrangement *represents* his or her ascribed or achieved roles in life; therefore, identity forms a pre-existing, stable substrate that is reflected in, rather than articulated through, mortuary practice. Following a similar logic, the spatial organization of cemeteries is taken to reflect social organizational features, such as corporate group or clan structure (Goldstein 1980; Saxe 1970).

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archaeology, from Durkheim and Hertz to Van Gennep and Turner, and contrasts the processual approach of New Archaeology to French sociological and British anthropological traditions, which embrace a broader understanding of mortuary practices to consider symbolism and ritual process, attitudes toward and engagement with the corpse, and beliefs about the soul and afterlife (see also Bloch and Parry 1982).

These middle-range theories of the Saxe-Binford program, linking social identity to burial treatment, derive primarily from ethnographic datasets (Carr 1995). Early attempts correlated various social attributes, such as subsistence regime and inheritance rules, with archaeologically observable social distinctions in mortuary practice (e.g., grave location, quantity of grave goods) to establish systematic relationships between the two bodies of data (Binford 1971; Saxe 1970).<sup>32</sup> Perhaps the best known theoretical model to emerge from this project was Saxe's Hypothesis 8 (later reformulated as the Saxe/Goldstein hypothesis), which posits that groups with distinct resource rights "will maintain formal disposal areas for the exclusive disposal of their dead," in effect, marking land tenure through lineage claims (Saxe 1970: 119). Goldstein (1981) importantly revises Saxe's hypothesis to stipulate that the maintenance of formal, exclusive burial grounds represents "only *one* means of ritualization" for consolidating resource rights (Morris 1991: 148).

This formal relationship between cemetery demarcation and resource control "has taken on an independent existence" in mortuary studies, often assumed rather than explicitly tested (Brown 1995: 13). Implicit in the Saxe/Goldstein hypothesis is an ideology of territoriality: tombs directly tie lineages to land, materializing corporate identity and claims to rightful ownership (Chapman 1981; Renfrew 1976). Environmental change and carrying capacity are often implicated in the long-term social, economic, and ecological processes thought to underlie mortuary territoriality and monumentality. Building off the work of Renfrew (1976), Chapman (1981) argues that population stress fosters competition for scarce resources within segmentary societies, engendering territorial behavior that is expressed in monumental tomb building. This

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<sup>32</sup> Binford's (1971) initial formulation of the relationship between social organization and mortuary practice relied on Human Area Relations Files of forty non-state societies; Carr (1995) expanded on this sample in his revision of Binford's hypotheses.

functionalist account positions geographic and demographic factors as determinants, or “prime movers,” of social structure and, by extension, mortuary practice (Patton 1993)

Other studies have probed the ethnographic literature at a more intimate scale to better understand variation and biases in the archaeological record. O’Shea (1981) analyzes the burial patterns of ethnographically documented Native American tribes and finds that social ranking is usually expressed by differences in associated artifacts and energy expenditure, whereas mortuary remains fail to reflect known horizontal social structures, such as kin-based moieties (cf. Carr 1995: 192). This kind of comparative analysis is expanded by Carr (1995), who systematically evaluates the philosophical and religious dimensions of mortuary practice, which are often overlooked in the processualist paradigm. In general, he finds that philosophical-religious factors explain mortuary variables to a similar magnitude compared to social factors. In fact, beliefs about the soul’s nature determine form of disposal, body preparation, and local grave location at a rate equal to or greater than vertical social position, undermining the primacy of social status in the interpretation of mortuary remains (see Carr 1995: Table XIV). Of particular note, the Saxe/Goldstein hypothesis is *not* strongly supported in this cross-cultural survey, given that “many social and philosophical-religious factors beyond the affirmation of economically corporate groups may be indicated by the bounding and exclusive use of a disposal area, be it a cemetery or a section within a cemetery” (Carr 1995: 182).

The ethnographic data expose yet other inconsistencies in mortuary behavior that undermine archaeological prediction. For example, grave good abundances may not necessarily reflect “the actual material conditions of a society or the actual wealth of any individual” (Ucko 1969: 266). Nor can the energetic investment in tomb construction be taken as a signifier of the elite status of its occupant(s). Among the Merina of Madagascar, elaborate tombs represent not

the material wealth of an individual, but the collaborative effort of a cross-section of society (see Bloch 1967, in Ucko 1969). For the Berawan of Borneo, tomb building itself is the status display, but because it is taboo to “prepare a mausoleum for someone not yet dead,” tombs may come to be occupied by “nobodies” (Metcalf and Huntington 1991: 149-150). Perhaps most troubling is the fact that even in contexts where funerary rites and cemetery organization are tightly prescribed, such as at Christian cemeteries, the organization of burial grounds are still subject to “personal idiosyncrasy, conflicting pressures, and human error” (Ucko 1969: 277).

The intricacies and inconsistencies of the ethnographic record compelled many scholars to call for the refinement of the comparative methods used to produce diagnostic criteria of different mortuary systems (Chapman and Randsborg 1981; O'Shea 1981; Ucko 1969). Chapman and Randsborg (1981: 13) even recognize the “the process of decision-making which lies behind the successive stages in ritual and burial,” anticipating—to a degree—the post-processual turn in archaeology. Carr (1995) also argues that perceived shortcomings of the Saxe-Binford program stem from confusion over the *proximate* and *ultimate* causes of mortuary variability, meaning that Binford did not mean to argue that social variables were not the *only* factors driving variation, just the ultimate ones; this interpretation creates room for culturally-specific beliefs, concepts, and practices to intervene in the mortuary process (Morris 1991). Recent research also demonstrates how a multivariate and contextual approach that not only considers grave goods and architecture, but also bioarchaeological data and the broader contexts of pre- and post-interment rituals, can achieve “a comprehensive social and religious reconstruction,” effectively implementing the Saxe-Binford program in a less absolutist fashion (Shimada, et al. 2004: 371).

Nevertheless, mortuary variation remains largely under-theorized in the processual paradigm in favor of finding *regularities* in spatial organization. Decision-making processes are

implicitly treated as ‘noise’ that the archaeologist must account for in order to identify organizational aspects of mortuary sites (but see Morris 1991). The structural bias of processual archaeology ultimately paved the way for a re-conceptualization of mortuary practices and their relationship to political process, social life, and human agency.

*Contestation and Contingency: The Politics of Mortuary Practice*

At the heart of the post-processual reformulation of mortuary theory is a basic fact about burial: *the dead don't bury themselves*. Decisions regarding who is buried, and the place and manner of their burial, are powerful ideological statements, rather than merely indexical of one's social status (Chesson 2001; Parker Pearson 1982). This fundamental insight underlies a diverse body of work on mortuary practices that takes the irregularities and particularities of burial treatment as its focus, calling attention to the historically contingent nature of social reproduction (Cannon 1989; Chapman 2000; Hodder 1982; Humphreys 1981; Parker Pearson 1982). Practice-based theories that contextualize the strategies of the living with regard to sociopolitical constraints on human action and culturally-conditioned attitudes toward the dead body provide a more theoretically complex and empirically rich approach to the study of the dead.

Over the past two decades, a practice-oriented approach to mortuary archaeology has increasingly widened its analytical and topical scope, to consider the complex behavioral, ideological, and spatial dimensions of burial practices, such as mourning and emotion (Joyce 2001; Meskell 2001), social memory (Chesson 2001; Gillespie 2001; Nielsen 2008), and ‘the space and place of death’ (Ashmore and Geller 2005; Silverman and Small 2002). These analyses foreground the temporal and material dimensions mediating interaction between the living and the dead. At a basic level, “individual cumulative actions [of successive burials]



become the structure which establishes a further cultural context for action” (Chapman 2000; Mizoguchi 1993). This temporal rhythm extends outward from the moment of burial to the scale of *cosmological time*, where individual memories of the dead are transformed into a broader ethos of ancestral power that energizes and permeates cycles of social and agricultural regeneration (Bloch and Parry 1982; Bradley 1991; Robb 2002; Velasco 2014).

Instrumental in the structuring of living-dead relationship over the *longue durée* is the materiality of the corpse itself. Drawing from theories of materiality and object agency (Gell 1998; Latour 2005), bioarchaeologists have begun to theorize how dead bodies—beyond eliciting culturally-patterned emotional *responses*—also possess the capacity to influence human *action* across multiple time scales (Crandall and Martin 2014). These approaches conceptualize “post-mortem agency” as emergent from dyadic and multi-node networks of living and dead bodies and the “social relationships, objects and exchanges through which personhood and remembrance are distributed and constituted” (Williams 2004: 267). Corpses and body parts are seen not only as repositories of social memory or symbols of political legitimacy, but as politically efficacious social agents that instantiate relationships of power, including domination and subjugation (Tung 2014). While the vital role of the corpse in shaping social life after death resonates across multiple cultural contexts, locating that “vitality” and “efficacy” proves to be a more elusive task (but see Velasco 2014). Whether or not “post-mortem agency” is epiphenomenal to the inferential capacities of sentient beings or exists outside of human agency by virtue of its materiality, mobility, and partibility (e.g., dead body parts circulating through time and space), there remains an ongoing debate among social theorists concerned with objects and their role in the constitution of political order and historical memory (Robb 2004; Smith 2015).

Rather than prioritizing the strategies of living agents or the materiality of dead bodies, I use the concept of ‘mortuary politics’ to encompass the broad field of action surrounding death and proper burial, including the manipulation of body parts for political ends as well as the political work that dead bodies ‘do’ in their material afterlives (Tung 2014; Verdery 1999). Mortuary politics thus articulate the conscious goals of political actors, affective experiences of mourners, and materiality of bodies and places of burial in the negotiation of contingent social relationships and their extension into future time (Brown 2008; Velasco 2014).<sup>33</sup> In conversation with the work of Verdery (1999) and Brown (2008), I identify three key, co-occurring elements of ‘mortuary politics’: crisis, reconstitution, and transformation. The existential crisis of death occasions social conflict and instability, especially in the context of regime change or political upheaval, but also makes possible the reconstitution of social and political authority centered on the deceased, as in the case of the king’s two bodies (Kantorowicz 1957).<sup>34</sup> Regardless of organizational structure (e.g., hierarchy or heterarchy), the vision of eternal leadership, permanence and timelessness, masks the contingencies of its production and can effectively work to naturalize historical transformation through an ideology of cyclical renewal and regeneration.

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<sup>33</sup> Brown (2008: 5) uses mortuary politics to characterize how “beliefs and practices associated with death” are mobilized toward particular goals. Verdery (1999: 22) similarly defines politics as “a form of concerted activity among social actors, often involving stakes in particular goals.” My conception of mortuary politics moves beyond ‘goal-oriented’ action to account for the structuration of mortuary practices over the *longue durée*.

<sup>34</sup> The relationship between the king’s body and body politic is encapsulated by the popular phrase “The King is Dead, Long Live the King!” The mortality of a ruler calls into question the timeless foundation of political power, and it is only through the royal funeral that social and cosmological order is reproduced (Metcalf and Huntington 1991). The integrative function of royal funerals is embodied in the monumental construction of state-level tombs that coordinate labor and visually center society. In Egypt, for example, pyramid construction centered on the person of the pharaoh “must have called into being an organizational apparatus and a corporate awareness that made other state ventures possible” (Metcalf and Huntington 1991: 161). A similar ‘corporate awareness’ was fostered in Athenian mortuary practice, where bounded cemeteries (ideally) demarcated citizenship—the state being “in effect a large descent group” (Morris 1991: 158).

Because the outcome of mortuary politicking is not predetermined, tracing the linkages between dead body politics, political economy, and historical transformation requires attention to “the connections between the particular corpses being manipulated and the wide national and international contexts of their manipulation” (Verdery 1999: 3). Verdery (1999) illustrates how struggles over dead bodies, involving the retrieval and relocation of corpses from abroad, were fundamental to the making of post-socialist nations after the fall of the Soviets. Here, dead body politics are strongly embedded in broader political economic relations, but they are not reducible to them. Rather, the dead enchant a more technical account of political processes by imbuing political practices of affiliation and difference with an “aura of sanctity” (Verdery 1999: 32). Brown (2008: 6) summarizes how the sacred mediates between the individual and the body politic:

Relations with the dead, by virtue of their powerful symbolism and association with things sacred, have the ability to connect private and public concerns, by aligning individual experiences of loss and memory with the interests of community, church, or state. This linkage makes the dead integral to both social organization and political mobilization, and therefore vital to historical transformation.

The role of the dead in the constitution of political order has long been an important theme in the archaeology of the ancient Americas, where the lines between the dead and living are blurred, if they even exist at all (Dillehay 1995b; Fitzsimmons and Shimada 2011; Shimada and Fitzsimmons 2015). Ritual and political economies involving the manipulation, circulation, exhumation, and desecration of ‘partible’ bodies worked to substantiate authority at key political junctures across the Mesoamerican sequence (Blomster 2011; Duncan and Schwarz 2015;

Weiss-Krejci 2011). Following the collapse of the Classic Period states, ancestor cult acted as a counterbalancing force to factionalism by underwriting a “sense of unity” among the various competing polities in the Mixtec region (Byland and Pohl 1994: 194-195, 202). In representational art, deceased rulers are often symbolized as “sacred bundles” of stone, bone, or other holy objects that contained their power and essence (Blomster 2011; Houston, et al. 2006). In some cases, the physical bodies of the ancestors themselves were transformed in mummy bundles that were housed in centrally located funerary caves and consulted by oracles in matters of political dispute (Byland and Pohl 1994).

By the same logic, the desecration of the body was just as potent and political as its preservation and veneration. As research by Duncan (2005; Duncan and Schwarz 2015) in the Petén lakes region illustrates, the political ascendance of the Kowoj ethnic group during the Postclassic period was in part founded upon ritual violence targeted at enemy bodies. Desecration of human remains at a mass grave from the site of Zacpetén “served to symbolically rupture the past inhabitants’ links to the site and to create an enduring symbol of their defeat” (Duncan and Schwarz 2015: 143). Duncan and Schwarz (2015) make a semiotic connection between the bundling of sacred relics in white cloth and the sealing of human remains beneath a white layer of limestone—an act of ritual containment that neutralized the power of enemy bodies, and in effect, instantiated a new world order.

Strong parallels can be drawn between the factional (mortuary) politics of Postclassic Mesoamerica and those of the late prehispanic Andes. In both regions, the place of burial and the body of the ancestor constituted key loci of political negotiation vis-à-vis dramatic (and often calamitous) social transformations, including state collapse and Spanish colonization. Following the collapse of the Andean states of Wari and Tiwanaku, above-ground *chullpas* and *machays*

(and the bodies they housed) positioned apical ancestors as an enduring basis of society and granted legitimacy to the political claims of their descendants (Nielsen 2008; Salomon 1995). Affective ties between descendants, their ancestors, and the living landscape enchanted the politics of burial at open sepulchers, incorporating mummified bodies into a cosmological topography of sacred landforms and objects, hydraulic cycles and circulating fluids that ensured sexual and social reproduction (Bastien 1985; Bastien 1995; Dean 2005; Salomon 1995; Weismantel 2004). Ancestral mummies were perceived as having a vegetative quality, likened to “dried or shriveled but still life-bearing and life-giving parts of plants” (Salomon 1995: 340). As transformed material beings, they shared in the same animating essence flowing through living and non-living things—bodies, mountains, stones, and tombs (Bray 2009; Velasco 2014).

Importantly, mummies were not merely metaphors for agricultural fertility or symbols of political legitimacy, but rather active participants in ongoing social life. Mummies were clothed, feted, and fed. They were paraded out in important ceremonies, consulted as advisers, and even employed as “ambassadors” in Inka imperial expansion (Bauer 2004). The urgency of dead body politics in the making (and unmaking) of political order tragically comes to the fore under Spanish colonial rule, when government officials and clergy members fervently pursued the destruction of ancestral mummies and other objects deemed idolatrous. Confronted not only by these policies of extirpation but also decimation from disease, lineage heads sought to recreate the legitimate basis of society by exhuming bones and bodies from church cemeteries and restoring them to ancestral shrines and burial graves. Gose (2008) shows how acts of surreptitious corpse removal not only placed conspirators in opposition to the Spanish Crown, but also exposed conflicts *within* communities over rightful inheritance and succession.

In contexts as diverse as post-Soviet Europe and Spanish colonial Peru, the dead body becomes a potent site of contestation and struggle—not only because of its remembrance as a once-living human—but also because of its indeterminacy as a political symbol, the ability to conjure dramatically different emotions depending on the beholder (Tung 2014). Mortuary politics, in effect, harness these emotions toward specific goals or normative ideals, shaping relationships between subjects and social structures (e.g., “the state”) across multiple time scales. Thus, a focus on the political dimension of mortuary practices does not negate the sacred. Rather, it calls attention to the capacity of dead, and the mortuary monuments that are extensions of their vitality, to stand as centers of communalism or axes of social differentiation.

#### Theoretical Models of Mortuary Practice

This dissertation is fundamentally concerned with the constitution and naturalization of political and social orders through mortuary practice and embodied identity, which collide in the decisions revolving proper disposal of the (once living) dead body. By exploring the convergence and disjuncture between multiple lines of biological and cultural evidence, I aim to show how the social and spatial organization of the dead operates as “theatre of social structure,” where power relations are enacted and performed (Salomon 1995). At one extreme, spatial and semiotic divisions between ancestors can work to naturalize structures of inequality among the living. At the other, the rituals surrounding death form a crucible for forging unifying political relationships that mute differences in lived experience and broadcast an ideology of integration. Neither strategy is wholly independent of the other; boundedness requires cohesiveness at one structural level, just as social solidarity implies a boundary between “us” and “them.”

The subsequent section distills salient themes in the ethnographic and archaeological literature on mortuary practices into two overarching models that contrastingly highlight the

social politics of exclusion and integration—the corporate group model and the inter-group alliance model.<sup>35</sup> These models work as a heuristic framework for conceptualizing social relationships of affinity and difference that are enacted and negotiated through particular mortuary regimes. However, as broadly applied to the late prehispanic Andes, they run the risk of prioritizing “groups” or “types” of burial organization in the processual sense, rather than, elucidating the social strategies and structural tensions that underlie the genesis and reproduction of mortuary practices over the *longue durée*. To do so requires a deep engagement with traditional arenas of political competition (kinship and political economy) that condition and converge with mortuary politics. Accordingly, I critique these models generally from the perspective of a practice-based approach and specifically as they have been applied to the broader geopolitical landscape of the Late Intermediate Period Andes.

#### *Mortuary Politics of Exclusion: The Corporate Group Model*

The corporate group model takes the Saxe/Goldstein hypothesis, in which formal cemetery spaces serve to reinforce norms of property transmission, and extends it to other social and semiotic domains beyond the economic.<sup>36</sup> In this model, mortuary towers cultivate an ideology of exclusion predicated on shared descent, resource rights, and political autonomy, intensifying social boundaries between competing kinship groups in the context of ecological stress and political upheaval (Bloch 1971; Mantha 2009; Renfrew 1976). Symbolically rich and polyvalent associations between ancestors, landscape, and resource control across time and space

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<sup>35</sup> These models parallel a similar heuristic division employed by Buikstra and Charles (1999), who differentiate between ancestral shrines, which are community based and exclusionary, and earth shrines, such as pilgrimage centers, which attract and unify diverse social groups. However, these models are not analogous to the network and corporate strategies of Blanton et al.’s (1996) dual-processual theory, even though there are points of commonality.

<sup>36</sup> Importantly, Goldstein (1980: 8) notes that formal disposal areas represent only “*one* means of ritualization” by which groups may reaffirm ancestral ties and resource claims.

attest the wide applicability of corporate group burial as a theoretical construct (Bastien 1978; Buikstra and Charles 1999; Chapman 1981; Goody 1962), but also the need to attend to culturally-specific formulations of kinship, community, and property (Morris 1991).

From a political perspective, ancestor cult consecrates the political and economic integrity of the social group through the authority of the ancestor. By materializing kinship ties to the land and rendering them timeless, corporate group burial can solidify resistance to outside encroachment. Consider the case of the Merina of Madagascar (Bloch 1981): on a fragmented landscape of limited arable land, rice cultivation depends on the territorial integrity of land-holding corporate groups (*demes*). *Demes* stress endogamy to protect land from outsiders, and their link with the land is materialized in megalithic tombs, where the corpses of *deme* members are intermingled, emphasizing a group ethic over individual identity. In contrast, the tombs of Merina kings stress the individuality of the ruler, even at the same time that they ideologically represent “the communal tombs of the whole kingdom” (Bloch 1981: 141). Thus, a tension exists between *deme* structure, which requires distinction for the purposes of social and agricultural reproduction, and an effort to incorporate social groups into the larger entity of the state. The intense relationship between tombs, resource control, and agricultural productivity effectively immunizes the Merina against state intrusion.

Because of its emphasis on resource control and territoriality, the corporate group model is strongly influenced by the processualist paradigm, yet it is not incompatible with agent-based approaches that emphasize burial as political strategy. Morris (1991) preserves the utility of Saxe’s Hypothesis 8 as an explanation for property transfer and resource access, but shifts the focus to the role of actors’ cognition—the frameworks of their decision-making—in mediating these processes. One may proceed with an empirical-analytical approach, so long as *a priori*



causal links between property, mortuary rites, and ancestors are not assumed, but rather connected within particular political and social contexts. This project tests these assumptions through a bioarchaeological approach that juxtaposes the place and manner of burial with markers of social differentiation writ upon the human skeleton. Social differences among the living may be embodied through food preference, intentional body modification, and ideals of endogamy, which intersect, but are not determined by, economic structures of resource access, exchange, and transmission.

#### *Mortuary Politics of Integration: The Inter-Group Alliance Model*

In contrast to the corporate group model, the inter-group alliance model highlights the capacity of mortuary practices to periodically integrate different lineages, communities, or polities through the co-burial and memorialization of their respective ancestors. In this scenario, the space and place of burial exerts a centripetal force and provides the ritual basis for social cohesion and alliance formation (Buikstra and Charles 1999; Carr 2006; Dillehay 1995a; Dillehay 2007). Even among societies ostensibly organized into corporate kin groups, such as the Araucanians of central Chile, ancestor veneration may actually promote an encompassing ethnic identity in the interest of political coordination between different social groups (Dillehay 2007). A key feature in these cases is an emphasis on the social integration of ancestors as a strategy to maintain political and economic alliances among the living, in which “mates, labor, food, and other material resources are regularly exchanged” (Carr 2006: 299). Inter-marriage between lineages and economic interdependence across social boundaries can serve to mitigate internal conflicts, buffering communities during times of social or ecological stress.

Themes of ritual integration versus social exclusion are especially salient in discussions of Native American burial traditions, where cemeteries and monumental mounds served as sites of seasonal or periodic gatherings—what Buikstra et al. (1998: 94) term “ritual aggregation loci.” During the Middle Archaic Period in the Illinois River Valley, floodplain cemeteries were frequented by seasonally mobile groups who “would have come together to discuss matters of mutual concern, to bury their dead, and to exchange mates, thus linking death and renewal, mortality and fertility” (Buikstra and Charles 1999: 208).<sup>37</sup> Among the Hopewell, mound-building as a strategy of social cohesion was embedded within a broader economic interaction sphere that involved trade in raw materials and exotic prestige items, include copper, obsidian, and marine shells (Carr 2006).

Although mound building practices are predominantly associated with Woodland cultures, protohistoric Oneota groups in northwest Iowa revitalized them in the wake of profound social upheaval brought on by European contact, depopulation, and exile from their native homeland (Betts 2010). Mound construction ritually integrated disparate social groups on a fragmented social landscape, recreating a sense of place, historical continuity, and societal rebirth; the creation of fictive kinship ties through communal construction and ritual practices “may have been employed as a pragmatic means to amalgamate nuclear or extended families rent by disease and ensure their continued social and economic viability” (Betts 2010: 105). This case is an important reminder that social solidarity and mortuary ceremonialism are not a closed, self-

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<sup>37</sup> Communal gathering at floodplain cemeteries contrasts with the mortuary territoriality of bluff crest mounds which presumably date to the same period. Buikstra and Charles (1999: 208) argue that “bluff top interments were strong statements of territorial ownership, where the ancestors validated privileged access to local resources.” The contemporaneity of inclusive and exclusive mortuary behaviors highlights how the heuristic models do not represent ideal types so much as strategies of social interaction that vary across the political landscape.

sustaining system, but rather fundamentally political strategies deployed in response to historical exigencies—a point which will be more fully addressed in the next section.

The ethos of communalism that underlies the inter-group alliance model should also not be mistaken for egalitarianism. Whereas exclusionary burial may characterize the tombs of both commoners and kings, alliance formation is typically depicted as a realm of chiefly activity, involving commensal feasting, exchange of prestige goods, and control over women in the regulation of marriage practices (Blanton, et al. 1996). Even within a tradition of mortuary ceremonialism oriented toward the ritual integration of disparate social groups, elite competition and status display materialized in monumental construction may have contributed to an “ideology of individual power and prestige” (Fagan 2000: 139; Topping 2010).

Archaeologically, this elite bias might be reflected in elaborate mortuary architecture, non-local grave goods, and demographic burial profiles skewed toward adult males; determining whether or not “elite” burial practices also crosscut social boundaries (rather than simply consolidating social class) requires closer consideration of bioarchaeological evidence for social diversity.

### *Practice and Process: Dynamic Configurations of Mortuary Politics*

Despite their usefulness as cross-cultural theoretical constructs, both the corporate group and inter-group alliance models fundamentally presuppose closed systems of group interaction, in which exclusionary or integrative tactics promote the stable reproduction of a predetermined social structure (Figure 3.1). The inherent structuralism of these models can be criticized on three fronts: 1) they presume ‘bounded’ groups without accounting for intra-group variation, or differences in the scale of exclusion or integration; 2) they bypass the role of memory and social position in mediating attitudes toward the dead and the perception of their efficacy as ancestors;

and 3) they prioritize the maintenance of social relations, leaving the causes and consequences of social and historical change over time undertheorized.

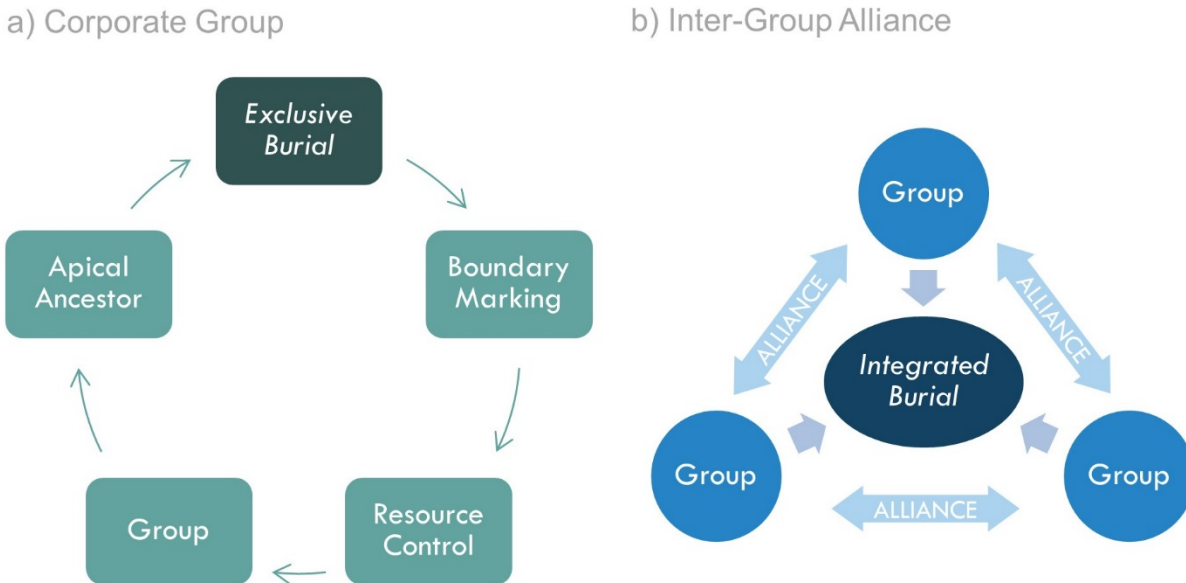


Figure 3.1. Heuristic models of mortuary practice.

In large part, a practice-oriented approach to mortuary politics circumvents these shortcomings by reinserting temporality and historical contingency into the study of mortuary practice. Framing these models as strategies of social interaction—rather than determinants of social organization—allows for more dynamic configurations of social identity and group politics to be hypothesized. Strategies of inclusion and exclusion may operate concurrently, vary by social class, or alternate in salience across time (Buikstra and Charles 1999; Dillehay 1990; Stanish 2012). “House societies,” for example, incorporate marriage alliance into corporate group structure, providing an alternative model for inter-*ayllu* relationships in the prehispanic area (Gillepsie 2000). Fictive kinship can also play an important role in the reckoning of group

membership and social status. For these reasons, corporate groups are not inherently bounded biologically, and practices of endogamy and exogamy often operate in tandem (Gillespie 2000: 7). Among ethnographically documented communities in the highland Andes, *ayllu* exogamy involving the marriage of two individuals from distinct villages or *ayllu* segments may be socially conceived of as endogamy at a higher structural level (Bastien 1978). This question of scale must be reckoned with when interpreting patterns of similarity or difference in the bioarchaeological record.

Attitudes toward the dead can also vary with the position of the social actor. An analysis of mortuary politics must ask *for whom* and *by whom* political relationships of exclusion or cooperation were cultivated. In the Merina example, tombs tie demes to their ancestral territories, but lost in this structural equation are those who have historically lacked property, political autonomy, and agency in the ritual economy: slaves (Graeber 1997; Graeber 2007). Although former slaves eventually began to adopt similar tomb building traditions, their attitudes toward ancestors differed from those of ‘white’ Merina, for whom ancestors are threatening, prone to punish their descendants for moral transgressions. As Graeber (2007: 203) explains, “ancestors were not felt to be nearly such a constraint for those who were struggling to find a solid place; history was not such a burden for those who’d had theirs stolen.” Here the “type” of burial is far less important than collective memory or historical experience in shaping relationships between the living and the dead.

Related to this, the degree to which burial practices foster inclusivity or exclusivity, and the nature of the “groups” involved in these processes, may change over time. Theories of identity formation provide an encompassing framework for conceptualizing the dialectical and diachronic relationship between integrative and exclusionary social strategies, which intersect

multiple social arenas of competition including, but not limited to, mortuary politics. Specifically, ethnogenetic models of biosocial transformation employ a heuristic life cycle of separation, liminality, and reintegration to conceptualize the practices and discourses by which social ties are atomized and reconstituted (Hickerson 1996; Stojanowski 2010). In the liminal phase, population reintegration—for example, the fusion of disparate social groups separated by demographic collapse—is achieved through tactics of inter-marriage and alliance formation that result in polyethnic or hybridized communities (Stojanowski 2010: 44-45). At the same time, ethnogenesis produces “new” forms of material and social practice that set apart one group to the exclusion of others (Bell 2005; Voss 2008). By definition then, ethnogenesis involves concurrent strategies of affiliation (‘coming together’) and differentiation (‘setting apart’), such that “group” identity emerges as the outcome of these dynamic relationships rather than their determinant. The analogs to the models presented in this study are clear, requiring that the temporal and scalar dynamics of corporate group differentiation and alliance formation be rigorously evaluated when interpreting bioarchaeological and chronological data in tandem.

Therefore, as a practical matter, the project design recognizes that data are unlikely to parse discretely into one heuristic model or the other. For example, dietary distinctions may exist between males and females, regardless of where they are buried and independent of other markers of social identity or biological relatedness. Through the synthesis of multiple lines of bioarchaeological and mortuary data, novel configurations of the corporate group and inter-group alliance models, in which social divisions cross-cut a broader sphere of interaction and exchange, will be explored in Chapter 8.

*Case Study: Above-Ground Burials in Late Andean Prehistory*

Understanding mortuary practice as a political process is of special relevance for scholars studying the political landscape of the Late Intermediate Period (LIP, A.D. 1000-1450) Andes. Situated between the collapse of Tiwanaku/Wari hegemony and the rise of the Inka Empire, the LIP is typically characterized as an era of political decentralization, increased hostility, and environmental instability (Arkush 2008; Covey 2008). Perhaps the most salient feature of this time period, at least in the southern and central Andes, is the evidence for widespread warfare (Arkush and Tung 2013). Hilltop fortifications (*pukaras*) speak to a heightened concern with defense, as well as the emergence of novel political structures that facilitated group cooperation and mobilization in the absence of state control (Arkush 2011; Kohut 2016). High rates of cranial trauma also attest to the prevalence of inter-personal violence and its very real effects on the human body during this politically tumultuous period (Arkush and Tung 2013; Kurin 2012; Torres-Rouff and Costa Junqueira 2006; Tung 2008; Tung, et al. 2016)

It is upon this politically fragmented landscape that the proliferation of above-ground burial traditions took hold. In the wake of the collapse (or rejection) of state authority, communities re-centered society around local lineages and their apical ancestors, housed in open sepulchers commonly known as *chullpas* (Janusek 2005). These mortuary buildings have traditionally been characterized as the ceremonial foci of *ayllus*, landholding kinship groups organized around ties of real and fictive kinship (Isbell 1997; Salomon 1995). Although some downplay “actual biological descent” as a key feature of the *ayllu* (e.g., Isbell 1997: 65), others argue that the households of an *ayllu* were ideally “to marry each other so as to keep durable resources within the immediate collectivity” (Salomon 1995: 321; see also Platt 1986). From this perspective, above-ground tombs materialized the genealogical foundation of the corporate *ayllu*

and reinforced ideals of *ayllu* endogamy by literally anchoring ancestors and their kin on the landscape.

Isbell (1997) most forcefully articulates a structural relationship between the open sepulcher and the Andean *ayllu*. Drawing heavily from ethnohistoric accounts of Inka and provincial mortuary practices, he argues that *ayllus* and *chullpas* emerge together during the Early Intermediate Period (A.D. 200-600), as a corporate group structure solidified in response to state-building processes and inter-regional hostilities. Isbell (1997) emphasizes the agency of kin groups in resisting the imposition of class-based state structure and defending their interests through the innovation of the ancestor cult. For him, ancestor veneration at *chullpas* “was about exclusion, group solidarity, ownership, and boundary formation much more than it was about building alliances, unifying great confederacies, and constructing racial identity” (Isbell 1997: 73). The parallels between this interpretation and Bloch’s (1981) account of the Merina are striking; both describe a social structure of endogamous, corporate landholding groups (i.e., demes, *ayllus*) anchored to the cultural landscape by their tombs—monuments to group autonomy from the encroaching state.<sup>38</sup>

Interpretations linking *ayllu* and open sepulchers also invoke formal hypotheses regarding mortuary practice and territoriality, in which tomb building serves to legitimize resource rights of segmentary social groups (Chapman 1981; Goldstein 1980; Renfrew 1976; Saxe 1970). Scholars in the Andes frequently interpret burial towers as marking stylistic and territorial boundaries between (elite) family lands, communities, or ethnic groups or polities, echoing Saxe’s model for

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<sup>38</sup> Interestingly, Isbell (1997) does not cite Bloch’s (1981) analysis of Merina mortuary practice, despite the clear parallels. Although his vision of *ayllu* and ancestor cult derives primarily from sixteenth and seventeenth-century ethnohistoric accounts, it is difficult to divorce his argument from broader theoretical perspectives regarding ancestors, resource rights, and social exclusion. Consider the quote from Isbell (1997: 73) in comparison to the following characterization of Chinese ancestor worship: “Those aspects of the cult that focus on the ancestral grave are more concerned with political competition than with glorifying rigid status hierarchies or group unity” (Watson 1988, cited in Buikstra and Charles 1999).



the rise of discrete disposal areas (e.g., Hyslop 1977; Kesseli and Pärssinen 2005; Mantha 2009). Nevertheless, Chapman (1981) and Renfrew's (1976) territorial model, which links population stress, resource competition, and mortuary monumentality, is rarely engaged theoretically or empirically in the Andean context (but see Dillehay 1990).<sup>39</sup> This is surprising given that population stress and resource competition generally figure prominently in theoretical models for widespread warfare during the LIP (Arkush 2008; Earle 1997).

While *chullpas* undoubtedly played a part in the constitution of in-group and out-group boundaries during the LIP (Mantha 2009; Parsons, et al. 1997), an over emphasis on boundary divisions potentially overlooks aspects of mortuary ceremonialism that were congregative in nature. Andean mortuary practices may have actually promoted coordination between local kin groups or the incorporation of outside groups, rather than their differentiation. Indeed the scalar nature *ayllu* organization, which involves higher levels of inclusiveness, cautions against a straightforward correlation between bounded cemeteries and isolated social units. Peter Gose (2008) in his analysis of Andean mytho-histories recounts how mortuary politics formed a crucial arena for the incorporation of pastoralist-outsiders into local social systems oriented toward ethnic complementarity. Archaeological evidence by Stanish (1992) in the Otoro valley and by Parsons and colleagues (1997) in the Junín region support this ethnohistoric model by suggesting that ritual integration at *chullpa* cemeteries may have accompanied the development of inter-zonal exchange relationships. Rather than strictly demarcating land rights and resources,

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<sup>39</sup> If monumental burial laid claims to important economic resources, then “there should...be a direct correlation between the distribution of burial monuments and their size and scale and their location in high and low areas of productivity” (Dillehay 1995b: 9). Yet few studies have formally tested the spatial distribution of *chullpa* towers against this premise. Recently, Arkush and Plourde (2010) provide initial support for a linkage between tombs and arable, lower lying terraces in the western Lake Titicaca Basin.

*chullpas* may have provided the vehicle for social integration and cooperation across social, ethnic, and economic lines.

Recent studies have begun to nuance the polyvalent associations between tombs, territory, and resources, revealing how social differentiation and communalism are complexly configured in and around open sepulchers. Mantha (2009) advances the territoriality hypothesis, but emphasizes that mortuary boundaries, like *ayllu* levels, operate along nested scales of inclusiveness from the household ancestor to community's founding ancestor (*malqui*). Thus, they cannot be reduced to eco-functionalist strategy. As important as resource control for understanding LIP geopolitics is social control—the political ideologies of inclusion and exclusion communicated by highly visible, imposing mortuary monuments.

Research by Arkush and colleagues in the Lake Titicaca Basin illustrates how *chullpas* were deliberately positioned on the landscape, not only to be visible to living descendants but also to remain vigilant over them, watching over their fields and settlements (Arkush 2013; Arkush and Plourde 2010; Bongers, et al. 2012). The role of ancestor as guardian suggests that *chullpas* should be approached not as single functional entities, but rather “as monumental embodiments of the ancestor itself, capable of doing what ancestors do,” from protecting fields to storing foods (Nielsen 2008: 220). Collectively, these studies and others document a remarkable range of *chullpa* spatial and architectural aesthetics, challenging the tendency to reduce general form to a single function across time and space (Velasco 2014).

Nevertheless, most interpretations of above-ground sepulchers in the Andes tend to gravitate toward one of the two heuristic models presented here: on one hand, *chullpas* are thought to represent the exclusive basis of corporate group membership reckoned through the apical ancestor (Isbell 1997; Mantha 2009); on the other, they may have constituted the ritual

basis of inter-group alliances between herders and cultivators, or among elites who partook in similar burial practices (Parsons, et al. 1997; Stanish 2012). These interpretations, informed by social theory as well as Andean ethnohistoric narratives, remain to be tested empirically.

In sum, how mortuary practices mediated inclusive or exclusive social boundaries during the late prehispanic era is an open question, and a flexible methodological approach is needed to more closely approximate the dynamic processes by which kinship, resource rights, gender identity, and ethnicity were negotiated through the idiom of burial. This dissertation builds upon previous research by offering a bioarchaeological perspective of LIP mortuary politics. Skeletal data, often lacking from *chullpa* studies because of pervasive looting, can shed light on the social identities of the deceased— independent of inferences made from the placement of tombs on the landscape—and allow us to explore patterns of inclusion and exclusion within and between above-ground mortuary sites.

### Bioarchaeological Approaches to Mortuary Practice

Bioarchaeology provides a framework for integrating multiple lines of evidence in the human body and tracing the construction and embodiment of social identity from the cradle to the grave. The integration of “conceptually and methodologically independent data sources” allows for a more nuanced social reconstruction of burial practices than is usually achieved with only non-biological material evidence, such as tomb architecture and grave goods (Gamble, et al. 2001: 186; Shimada, et al. 2004). This dissertation investigates how conflict and cooperation were mediated through the body and its treatment after death. Specifically, I examine: 1) patterns of intentional cranial vault modification (CVM) to test if bodily markers of social identity correspond to burial location; 2) genetically heritable traits on the human skull to test if

cemeteries were organized by biological kinship and to evaluate scenarios of boundary maintenance via endogamy or alliance formation via inter-marriage; and 3) stable carbon and nitrogen isotopes from bone collagen to reconstruct diet and shed light on subsistence differentiation and resource access.

In this section, the theoretical basis of these three methodologies and their relevance to the study of social integration and differentiation in the mortuary realm are summarized below. Drawing from case studies from around the globe and the Andes in particular, the corporate group and inter-group alliance models are decomposed into testable hypotheses and expected patterns of biocultural variation. If a corporate group model underlies *chullpa* traditions in the Colca Valley, then the maintenance of separate burial spaces will coincide with other forms of social, biological, and material differentiation among the living, thereby reinforcing an underlying rationale of social exclusion. Alternatively, if burial in open sepulchers fostered social alliance among elites or diverse social groups, then bioarchaeological indicators are expected to indicate a cohesive identity that crosscut competing lineages and provided the ritual basis for their integration.

#### *Cranial Modification and Social Interaction*

Inter-group differences in cranial vault modification (CVM) prevalence and type will test if this salient signifier of embodied identity reinforced social boundaries based on gender, kinship, subsistence practice, or burial location. Because CVM must occur during the first few years of life, when the bones of the cranial vault are still malleable, it represents the indelible inscription of a particular social identity onto the body of a child. Its deliberateness and permanence as a cultural act distinguishes it from other aspects of social identity that may be

more passively assumed, making it an ideal correlate for tracing the *intentional* construction of group identity in the past.

In the Andes, frequency and standardization of CVM have been shown to increase with level of social complexity in multi-regional analysis of small-scale and complex societies (Torres-Rouff 2003). Two general types of CVM, annular and tabular erect, have been characterized for the Andes and traditionally associated with highland and coastal populations, respectively. However, Hoshower et al. (1995) note that the use of CVM type as a general indicator of geographic origin is too simplistic. Rather, cranial modification in the Andes may have signified local lineage differences (Hoshower, et al. 1995), economic specialization (Buikstra, et al. 2005), and/or ethnic affiliation (Blom 2005)—dimensions of Andean social life that often intersect but are not necessarily isomorphic with one another (see Reycraft 2005). The vast majority of studies find no clear-cut association between social status or skeletal sex and the presence or type of cranial modification (Blom 2005; Carmichael 1995; Hoshower, et al. 1995; Pechenkina and Delgado 2006; Torres-Rouff 2003). Nevertheless, its precise relationship to social identity in the Andes is equivocal and should be pursued on a case-by-case basis.

Because its meaning and practice varies situationally and chronologically, Mannheim et al. (in press) argue for an approach to CVM that is distinctly localistic, with special attention “both to the array of features of the social landscape...and to the specific histories of the sites.” This contextual analysis involves tracing the intersection of embodied identity with other features of burial treatment that can shed light on the identity of being modified, its perception by others at the moment of death, and its recursive relationship to the construction of social relationships within living communities. Hoshower et al.’s (1995) landmark study of CVM patterning across multiple cemeteries in the Moquegua Valley provides strong evidence of

boundary maintenance that conforms to the corporate group model. Hoshower et al. (1995: 156) interpret within-group homogeneity in deformation style, but between-group difference, as indicative of “residential descent groups—perhaps *ayllus* or *ayllu* clusters—whose corporate nature was symbolized by unified cranial forms.”

In contrast, heterogeneity of CVM style within single cemeteries would support a more fluid model where corporal differences do not coincide with mortuary divisions, pointing to an underlying rationale for the social integration of ethnically or socially diverse individuals. Pechenkina and Delgado (2006: 232) observe that individuals with and without marked cranial deformation were buried side-by-side at the Early Intermediate Period (100 B.C.-A.D. 100) coastal cemetery of Villa El Salvador XII, evidence that each group was perceived “as part of an integrated whole,” despite differences in lived experience and subadult health that probably stem from growing up in different regions.

Across Chiribaya-affiliated sites in the Ilo valley (A.D. 1000-1300), distinct CVM styles signaled differences in subsistence and ethnic affiliation, but did not preclude integrated burial in some cases (Buikstra, et al. 2005; Lozada and Buikstra 2002). One tomb at the site of Chiribaya Alta, for example, includes a wealth of grave goods and three mummy bundles—one male, two females—who differ in cranial modification style, reflecting different occupational specialization (fronto-occipital/agriculturalist vs. annular/fisher, respectively). However, all three individuals show high levels of marine consumption, indicative of a shifting political economy, in which new trade relations with the coast were sought. In this sense, the probable marriage alliance and co-burial of individuals from different ethnic enclaves served to solidify “new power relationships in the absence of Tiwanaku state control” (Buikstra et al. 2005: 80). CVM diversity in the Colca Valley may have similarly mapped onto subsistence differences between

agriculturalists and pastoralists. However, because ethnohistoric sources suggest head shape, economic specialization, and kinship were intimately linked, material evidence of CVM will be considered in conjunction with the indices of biological affinity and diet outlined below.

### *Phenotypic Variation and Gene Flow*

The frequency of heritable morphological traits of the skull can be analyzed statistically to assess biological relationships within and across cemeteries, under the intuitive premise that phenotypic variation is lower among closely related individuals (e.g., Gamble, et al. 2001; Harper and Tung 2012; Stojanowski, et al. 2007; Stojanowski and Schillaci 2006). Although lacking the power to specify particular kin relations (e.g., cousin), intra-cemetery biodistance analyses can potentially detect kin relatedness at different scales, from “families” (Alt and Vach 1995; Bondioli, et al. 1986) to larger social units such as clan or lineage (Birkby 1982).<sup>40</sup>

In addition, the comparison of sex-based phenotypic variation can inform on patterns of male or female exogamy: the more migratory (exogamous) sex will display greater within-group heterogeneity, but lower between-group variation, if each group receives some marriage partners from the same outside communities (Konigsberg 1988; Lane and Sublett 1972; Stojanowski and Schillaci 2006). As Stojanowski and Schillaci (2006: 64-65) emphasize, practices of postmarital residence “can play an essential role in regional integration or aggregation by promoting the development of trade networks, defensive alliances, and solidarity within and among ethnically or linguistically diverse communities through intermarriage.” For example, greater phenotypic variability among males, consistent with the in-migration of males and residence organized

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<sup>40</sup> Within large undifferentiated cemeteries, the presence of a “family” can also be hypothesized a priori by considering demographic profile and associated artifacts, and then tested by comparing trait frequencies of the suspected family to overall cemetery frequencies (Alt and Vach 1995).

around female lines, has been correlated ethnographically with the reduced frequency of internal warfare (Birkby 1982; Ember and Ember 1971; Nystrom and Malcom 2010). Thus, biodistance analysis can indirectly inform on social strategies of affiliation during a time of intense and widespread warfare such as the LIP.

In the Andes, biodistance analysis of metric and non-metric skeletal traits predominantly operates at the population level, exploring the relationship between migration, inter-regional gene flow, and large-scale social changes, such as state formation and dissolution (Bethard 2013; Blom, et al. 1998; Nystrom 2006; Pink 2013; Rothhammer, et al. 2006; Sutter and Mertz 2004; Sutter and Sharratt 2010; Varela and Cocilovo 2000). Biodistance analysis can also address local effects of these population-level processes and demographic transformations through the identification of closely related kin and genetically diverse individuals buried together (Corruccini and Shimada 2002; Haun and Cock Carrasco 2010; Nystrom and Malcom 2010; Shimada, et al. 2004). The question of *ayllu* endogamy and its relationship to cemetery structure has also been approached through biodistance analysis (Blom, et al. 1998; Haun and Cock Carrasco 2010). For example, Blom et al. (1998: 252) suspect a scenario of gene flow between *ayllus* at the Middle Horizon site of Chen Chen, where a signal of genetic affinity, along with “a mixing of cranial deformation types,” suggests *ayllus* were not endogamous at the site.

In sum, intracemetery biodistance approaches provide a theoretical and methodological basis for hypothesizing phenotypic correlates of the corporate group and inter-group alliance models. If group endogamy reinforced the social autonomy of corporate kin groups, then biological distances between burial groups should be larger than expected under the null model. In contrast, no significant differences between burial groups would indicate low genetic diversity, which suggests that marriage practices may have been used to diminish boundaries, or



that there were more fluid conceptions of kinship in which biological affinity did not determine membership in the family or household (Pilloud and Larsen 2011). With regard to the inter-group alliance model, the analysis of sex-specific morphological variation can potentially discern patterns of postmarital residence that would inform on strategies of social interaction and economic exchange during a politically fractious period of Andean history.

Ultimately, most bioarchaeologists would concede that documenting phenotypic similarities or differences between and among groups—in and of itself—is a rather narrow and uninspiring pursuit. While “simply documenting the presence of kin-structured burial does not advance anthropological knowledge” (Stojanowski and Schillaci 2006: 80), when overlaid with artifact distributions, for example, it can shed light on the relationship between kinship, leadership roles, and social power (Howell and Kintigh 1996). In general, biodistance analysis is most effective when compared and contrasted against other lines of archaeological, biocultural, and historical evidence, which can situate biocultural processes of differentiation and integration in relation to the construction of social memory and political ideology (Ortman 2012; Stojanowski 2010). Bioarchaeologically, the integration of sex-specific phenotypic data with data on trauma, physical activity, mobility, and burial treatment can advance discussions of gendered marriage practice beyond a framework of “mate selection” toward more socially dynamic models that recognize the role of violence, including raiding and bride kidnapping, in the incorporation of women into patriarchal societies (Martin, et al. 2010; Voss 2015).

### *Stable Isotopes and Dietary Differentiation*

Dietary reconstruction based on carbon and nitrogen isotope analysis will show whether mortuary practices correlate with differences in diet, which may reflect subsistence distinctions,

inequalities in resource access, or dietary preferences (Tung, et al. 2016). Carbon isotope ratios ( $^{13}\text{C}/^{12}\text{C}$ ) from bone collagen, employed in the present study, reflect the relative contribution of protein sources in the diet and can be used to distinguish between the consumption of plants that utilize the C3 or C4 photosynthetic pathways (e.g., maize vs. tubers) (Ambrose, et al. 1997; Kellner and Schoeninger 2007). Stable nitrogen isotopes reflect  $^{15}\text{N}$  enrichment along the trophic chain, such that individuals consuming more animal protein will have higher  $^{15}\text{N}/^{14}\text{N}$  ratios than those feeding mainly off terrestrial plants (Schoeninger, et al. 1983). Consumption of marine resources also results in elevated nitrogen ratios (> those of terrestrial animals), although marine ecosystems were unlikely food sources in the high altitude regions of the Colca Valley.

In the Andes, stable carbon and nitrogen isotope analysis of human bone has been used to explore patterns of economic specialization and interaction among fisherfolk, farmers, and herders (Slovak and Paytan 2009; Tomczak 2003); immigration and social diversity (Turner et al. 2010); and the effects of state formation and collapse on political economy, diet, and social inequality (Berryman 2010; Finucane 2009; Kellner and Schoeninger 2008; Kurin 2016a; Tung, et al. 2016). The identification of maize consumption through stable carbon isotope analysis is especially significant in the Andes since maize, as both a food staple and brewed beverage, was ritually and economically important across Andean political economies throughout prehistory, having been linked to the rise of political complexity and the maintenance of social divisions in the major state-level polities of the Middle Horizon and Late Horizon (e.g., Berryman 2010; Finucane 2009; Hastorf and Johannessen 1993).

By examining patterns of intra- and inter-site distribution of dietary isotope values, stable isotope analysis can trace correspondences and disjunctures between diet and other indicators of social identity, such as cranial modification and biological affinity. Across Chiribaya-affiliated

sites in the lower Osmore drainage, Tomczak (2003) detects the presence of distinct subsistence enclaves situated in coastal and mid-valley ecological zones. However, clear distinctions between *labradores* (agriculturalists) and *pescadores* (fisherfolk) in resource access and cranial modification styles do not coincide with patterns of biological affinity, which instead point to genetic homogeneity across the region (Lozada and Buikstra 2002).<sup>41</sup> Additional craniometric analysis of sex-specific patterns of phenotypic variation, conducted by Nystrom and Malcom (2010), shows that males are generally more variable than females, especially at elite Chiribaya Alta cemeteries. Such a pattern suggests males were the more mobile sex (following Konigsberg 1988), possibly reflecting “an exchange network where elite males moved from their natal home to reside in their complementary ethnic group, facilitating the economic and political integration of the Chiribaya *señorío*” (Nystrom and Malcom 2010: 393).

With regard to the heuristic models proposed in this dissertation, mortuary and dietary profiles can be compared to infer if different social groups, based on shared kinship, geographic origin, social status, and/or subsistence, were integrated or differentiated through funerary practice. Based on high carbon values indicative of maize subsistence, Cook and Schurr (2009) infer that Mississippian migrants were incorporated into Fort Ancient communities and argue that their presence in “local” burial groups signals marriage alliances during a time of environmental change. In contrast, Bras-Goude et al. (2013) document dietary differentiation among Neolithic populations in southwest France that corresponds to distinct mortuary treatments (chamber vs. pit burial), suggesting that funerary practices reinforced socio-economic

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<sup>41</sup> In fact, gene flow between valley segments likely accompanied by economic exchanges, since neither coastal nor inland groups subsisted solely on marine or terrestrial resources, but rather supplemented their diet with resources from other zones (Tomczak 2003). Taken together and considered within their larger biocultural context, isotopic and biodistance data broadly support an ethnohistoric model of horizontal complementarity, in which economically specialized groups engaged in horizontal exchange of resources.

and territorial organization of groups oriented toward herding and farming. In light of known structures of ethnic and economic difference in the Colca Valley, similar processes of mortuary differentiation may have also occurred. Alternatively, the location of mortuary sites in the ecological border between high altitude herding grasslands and valley bottom agricultural fields presents the possibility that burial grounds were accessed by agriculturalists and pastoralists alike.

In sum, between-group differences in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  are expected if social boundaries structuring differential access to maize and/or camelid protein were reinforced by the territorial mortuary politics prescribed by the corporate group model. Under the inter-group alliance model, however, shared diet and exchange in resources is expected to produce an isotopic leveling effect with similar isotopic signatures across burial groups. Specifically, if above-ground tombs cultivated an encompassing 'elite' identity, then carbon values should show substantial C4 consumption ( $\delta^{13}\text{C} = \sim 12.5\text{‰}$ ), likely from maize and maize beer (*chicha*), a prestige-laden foodstuff associated with feasting in the Andes (Berryman 2010; Finucane, et al. 2006; Hastorf and Johannessen 1993).

### *Hypotheses and Bioarchaeological Correlates*

**HI. Corporate group model:** If mortuary sepulchers signaled kinship and landholding rights, then individuals buried together should show stronger signs of biological relatedness (inferred from heritable morphological traits on the skull) and shared resources (indicated by dietary isotope ratios in bone collagen), compared to individuals buried apart. They should also exhibit homogeneity in identifiers of in-group membership such as artifacts and intentional cranial vault modification. Stylistic, biological, or dietary differentiation between burial groups

would suggest that mortuary practice played an integral role in the constitution of a fragmented social landscape during the LIP by normalizing ritual boundaries and resource inequalities between different segments of society.

***H2. Inter-group alliance model:*** In contrast, resource sharing and inter-marriage among social groups that share mortuary rituals and spaces in common are expected to result in biological and dietary homogeneity across the burial population. Sex-based differences in indices of biological affinity could further illuminate the direction of marriage exchange and postmarital residential practices. At the same time, heterogeneity in cranial modification and artifact styles within single mortuary contexts would point to a socially diverse burial population. This scenario suggests that mortuary practices coordinated social and economic interactions among the living by providing a ritual foundation for social alliance, which in turn may have buffered local populations from social or ecological stressors during the LIP.

***H3. Dynamic social boundaries:*** Alternatively, practices of exclusion or inclusion based on kinship, gender, status, or other dimensions of social affiliation may not coincide with mortuary boundaries or even concord with one another. The disjuncture of multiple lines of bioarchaeological evidence, rather than their alignment under one of the heuristic models, can potentially illuminate the nuanced ways in which mortuary politics intersect, reinforce, or subvert the lived experience of social identity. For example, distinct subsistence or occupational practices based on gender identity or cranial modification status may result in health inequalities that are nonetheless muted through common burial rituals (undergirded by an ideology of equality in death). Understanding how embodied social differences were embedded within more encompassing structures of social affiliation can shed light on complex dynamics of conflict and cooperation within a single cultural region during the LIP.

Finally, given evidence of diaspora, inter-regional gene flow, and multi-ethnic settlement in the Andes (e.g., Lewis Jr., et al. 2007; Martínez C. 1998; Owen 2005), it is also possible that Collagua mortuary practices incorporated outsiders into the local social system. Because the present study is oriented toward local group dynamics, a systematic consideration of inter-regional migration is beyond its scope, yet biodistance analysis can suggest if in-migration indeed occurred. Presumably, if a number of immigrants were buried in these sepulchers, then bioarchaeological data should exhibit *unpatterned heterogeneity*, as well as a motley assemblage of local and intrusive artifacts and cranial modification styles.

## Summary

Through the treatment of the dead, mourners create, contest, and reproduce social and political boundaries among the living. This chapter synthesized two heuristic models of boundary formation through mortuary practice that carry distinct implications for inter-group conflict and cooperation during the LIP. In the “corporate group” model, tomb building serves to legitimize the social and economic autonomy of competing kinship groups, especially in the context of population stress and resource competition (Bloch 1981; Chapman 1981; Goldstein 1980; Renfrew 1976; Saxe 1970). In the “inter-group alliance” model, mortuary practices provide a vehicle for the integration of diverse social groups through inter-marriage and resource exchange (Buikstra and Charles 1999; Carr 2006; Dillehay 1995a; Dillehay 2007). These heuristic models imply distinct social and biological correlates detectable through the analysis of mortuary artifacts and human skeletal remains.

Three primary data classes, their theoretical relevance to the study of mortuary politics, and expected bioarchaeological correlates under each heuristic model were expounded in the

final section of the chapter. Under the corporate group model, exclusionary politics predicated on within-group solidarity should result in between-group differentiation in cranial modification style, biological relatedness, and dietary practice. In contrast, patterns of within-group heterogeneity but between-group homogeneity will suggest that access to open sepulchers crosscut lineage divisions and social boundaries to cultivate an encompassing identity, perhaps as a strategy to consolidate intra-valley cooperation against external threats or periodic resource shortages. Chapters 5-7 will examine these two scenarios, as well as dynamic alternatives that integrate strategies of social exclusion and integration, to assess the degree to which mortuary practices intervened in processes of political fragmentation, state formation, and ethnogenesis in the Late Intermediate Period Colca Valley.

## CHAPTER 4

### MATERIALS AND METHODS

#### Introduction

The skeletal material analyzed in this study derive from archaeological excavations directed by the author in 2012-2013 in the district of Coporaque, located in the central Colca Valley (Province of Caylloma, Region of Arequipa). Two mortuary sites, previously documented by Wernke (2003), were targeted for excavation because of their excellent preservation of human remains and probable association with distinct archaeological sites, as inferred from spatial and ethnohistoric evidence. In addition to human remains, Proyecto Bio-arqueológico Coporaque recovered ceramics, textiles, and other cultural materials, including decorative artifacts and grave goods, that are the subject of separate and ongoing investigation (Ferrando Verástegui and Velasco 2014).

In this chapter, I provide a brief summary of the archaeological and temporal context of the human skeletal remains, which will structure comparative analyses based on burial location and chronology.<sup>42</sup> Osteological methods used to estimate age and sex from the cranium are also summarized.<sup>43</sup> The bulk of the chapter will detail the methodological approaches for the analysis of the three primary data classes used in this dissertation: cranial vault modification (CVM), cranial non-metric traits, and stable carbon and nitrogen isotopes from bone collagen.

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<sup>42</sup> A complete description of excavation loci can be found in Ferrando Verástegui and Velasco (2014). Radiocarbon dates from archaeological contexts are presented in detail in Appendix A.

<sup>43</sup> Demographic profiles for each mortuary site are presented in Appendix B.



## Study Sample

A large collection of well-preserved human remains was excavated from six mortuary contexts at Yuraq Qaqa (CO-098) and Sahuara (CO-118). Pervasive looting at both sites have largely disassociated cranial and postcranial remains, inhibiting the reconstruction of complete skeletal individuals. Although Proyecto Bio-arqueológico Coporaque also recovered and inventoried thousands of postcranial elements, this dissertation focuses primarily on cranial remains, in order to integrate multiple lines of bioarchaeological, phenotypic, and isotopic evidence within discrete individuals. In all, a minimum number of 231 crania were excavated during the course of the project.

Sample sizes for each data class are summarized in Table 4.1. The parameters of each analysis result in varying sample sizes. For example, 213 of 231 crania have the vault bones sufficiently preserved to observe morphological changes related to CVM. For biodistance analysis, only adult individuals with at least five observable non-metric traits (N = 152) were considered, while stable isotope analysis was conducted on bone collagen from a representative sample of adults (N = 46).

Table 4.1. Summary of samples used in this study, by data class.

Site	Chamber	Time Period	MNI	CVM	Non-metric	Stable Isotope
Yuraq Qaqa	003	Late LIP	28	28	23	7
Yuraq Qaqa	027	Late LIP	16	13	8	2
Yuraq Qaqa	028	Early LIP	5	5	3	1
Yuraq Qaqa	035	Late LIP	76	73	53	16
Yuraq Qaqa	051	Early LIP	7	6	4	2
Yuraq Qaqa	054	Late LIP	14	10	8	3
Sahuara	--	Early LIP	83	76	51	15
Total			229 <sup>a</sup>	211	150	46

<sup>a</sup> Total MNI excludes two complete crania from an excavation locus intermediate to Chamber 027 and Chamber 028. Temporal association of these specimens is unknown. They are included in overall frequencies and in biodistance analysis where samples from Chambers 027 and 028 are combined.

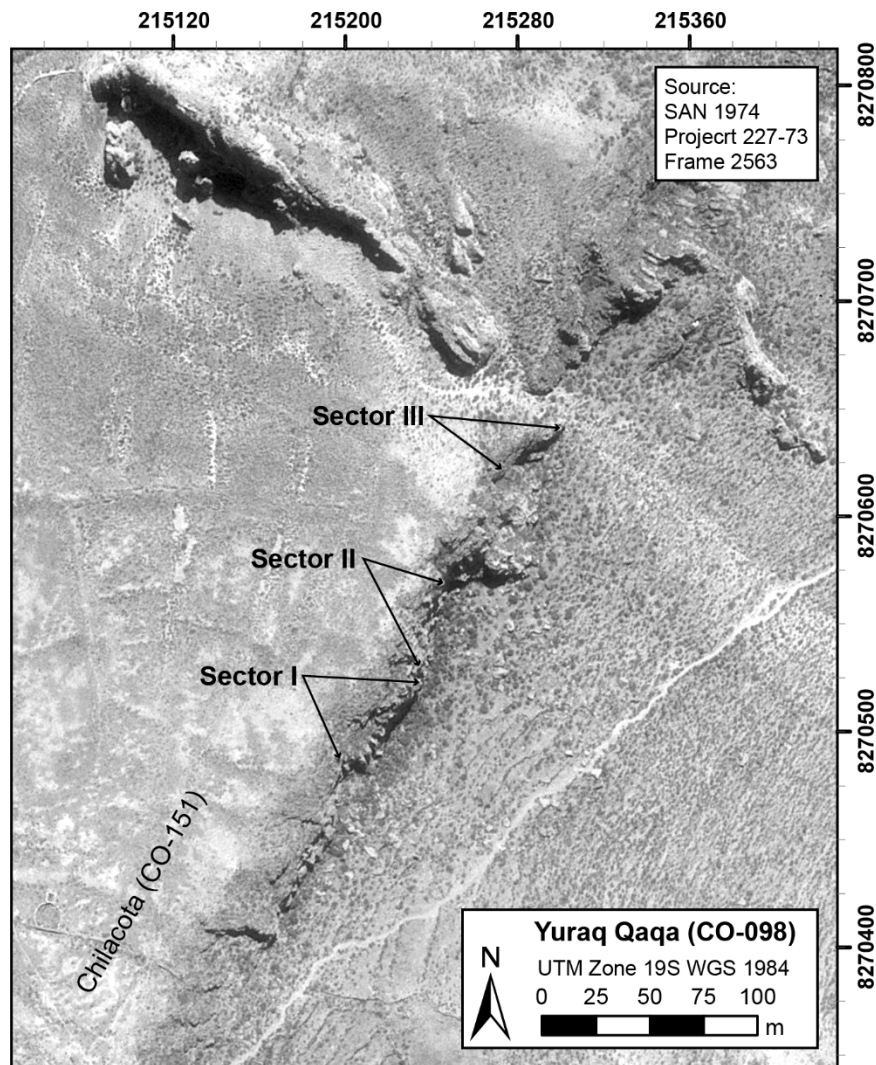


Figure 4.1. Airphoto of Yuraq Qaqa with sectors indicated.

### *Site Descriptions*

#### Yuraq Qaqa (CO-098)

Yuraq Qaqa (CO-098), also known as Fatinga, is the largest and most elaborate *chullpa* cemetery in the central and upper Colca Valley, located to the west of the modern town of Coporaque (Wernke 2013).<sup>44</sup> The site extends for 160 m along a rocky escarpment below the

<sup>44</sup> Yuraq Qaqa derives its name from the geological formation on which it is located, Yurac Ccacca, which means “white rock” in Quechua. Locally the site is sometimes referred to by the names of the archaeological sites located to its west and south, Chilacota and San Antonio, respectively (e.g., “Tumbas de Chilacota”). Wernke (2003) assigns

eastern edge of Chilacota (CO-151) (Figure 4.1). Ranging in altitude from 3,750-3,810 masl, the cemetery lies in the *suní* ecological zone between high altitude herding grasslands (*puna*) and valley bottom agricultural fields (*kichwa*). Yuraq Qaqa was most likely the elite cemetery of inhabitants of San Antonio (CO-100), one of two primary Collagua settlements during the Late Intermediate Period (Wernke 2013).

Above-ground funerary structures at the cemetery are characterized by an agglutinative construction process, whereby modular chambers abut one another and adjacent cliff face, forming a honeycomb-like complex of “buildings for the dead” (Velasco 2014; Wernke 2013). On average, chambers measure 1.87 m wide by 1.75 m deep and typically feature corbel-vaulted roofs, cornices, and small doorways facing east. Each chamber would have originally contained anywhere from a few to dozens of mummy bundles (*capullos*) that were prepared by clothing and wrapping the desiccated corpse in textiles and encasing it in a cocoon-like basket of woven vegetal fibers. Architectural analysis of wall abutment patterns reveals multiple phases of construction, which required the functional closure of lower-level chambers to raise a terrace foundation for subsequent construction (Velasco 2014). On average, chambers built later in the sequence are larger in size, which may suggest an expanding elite class or a greater emphasis on mortuary communalism (Velasco and Rodríguez Sotomayor 2014).<sup>45</sup>

Proyecto Bio-arqueológico Coporaque documented over fifty funerary structures (“chambers”) roughly organized in three areas, or sectors (Figure 4.1). Sector I includes the primary concentration of funerary chambers at the site, featuring the best preserved and most

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the name “Fatinga,” a local toponym for the site area but one that is not commonly used to refer to the tombs themselves. In the interest of facilitating the dissemination of research results to the local community and broader public, I use the more popular site name.

<sup>45</sup> Temporal variation in chamber size partly accounts for the disparity in MNI between the Early LIP (N = 26) and Late LIP (N = 120) at Yuraq Qaqa, since tombs built later in the architectural sequence could hold more individuals.

elaborate *chullpas*. The primary concentration consists of a succession of 28 contiguous chambers (N° 003-030), extending approximately 32 meters from one extreme to another (Figure 4.2 and Figure 4.3).<sup>46</sup> Three chambers were excavated in Sector I: 003, 027, and 028. Chamber 003 abuts a cluster of semi-circular chambers located at the southern extent of the concentration. It is architecturally and spatially distinct from Chambers 027/028, which are rectangular in form and located at the northern extent. Although Chambers 027 and 028 abut one another vertically, they represent architecturally distinct episodes of construction. Chamber 028 is a “primal structure” in the architectural sequence, meaning that it does not use previously built structures—only the cliff face—for architectural support (Velasco 2014: Fig. 3a). A radiocarbon date from botanical inclusions in the wall mortar of Chamber 028 is the earliest date from Yuraq Qaqa (931 ± 25 B.P., cal A.D. 1046-1219). Chamber 027, however, is a fourth-generation chamber, meaning that three construction events must have necessarily preceded it. Wall mortar from an adjacent third-generation chamber provides a *terminus post quem* date for the construction of Chamber 027 (554 ± 25 B.P., cal A.D. 1400-1443). Appendix A elaborates on the archaeological and radiometric evidence for the temporal separation of these adjacent structures and the human remains recovered from them.

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<sup>46</sup> Chambers 001 and 002 were also registered in Sector I, but they are isolated from the primary concentration. These chambers are built into an opening of the cliff face as an elaborate, two-story construction, suspended more than 2 m above the hillside on top of a double terrace (Ferrando Verástegui and Velasco 2014; Wernke 2013: Fig. 4.38.). Only scattered, fragmentary elements were observed in this heavily looted but architecturally elaborate *chullpa*.

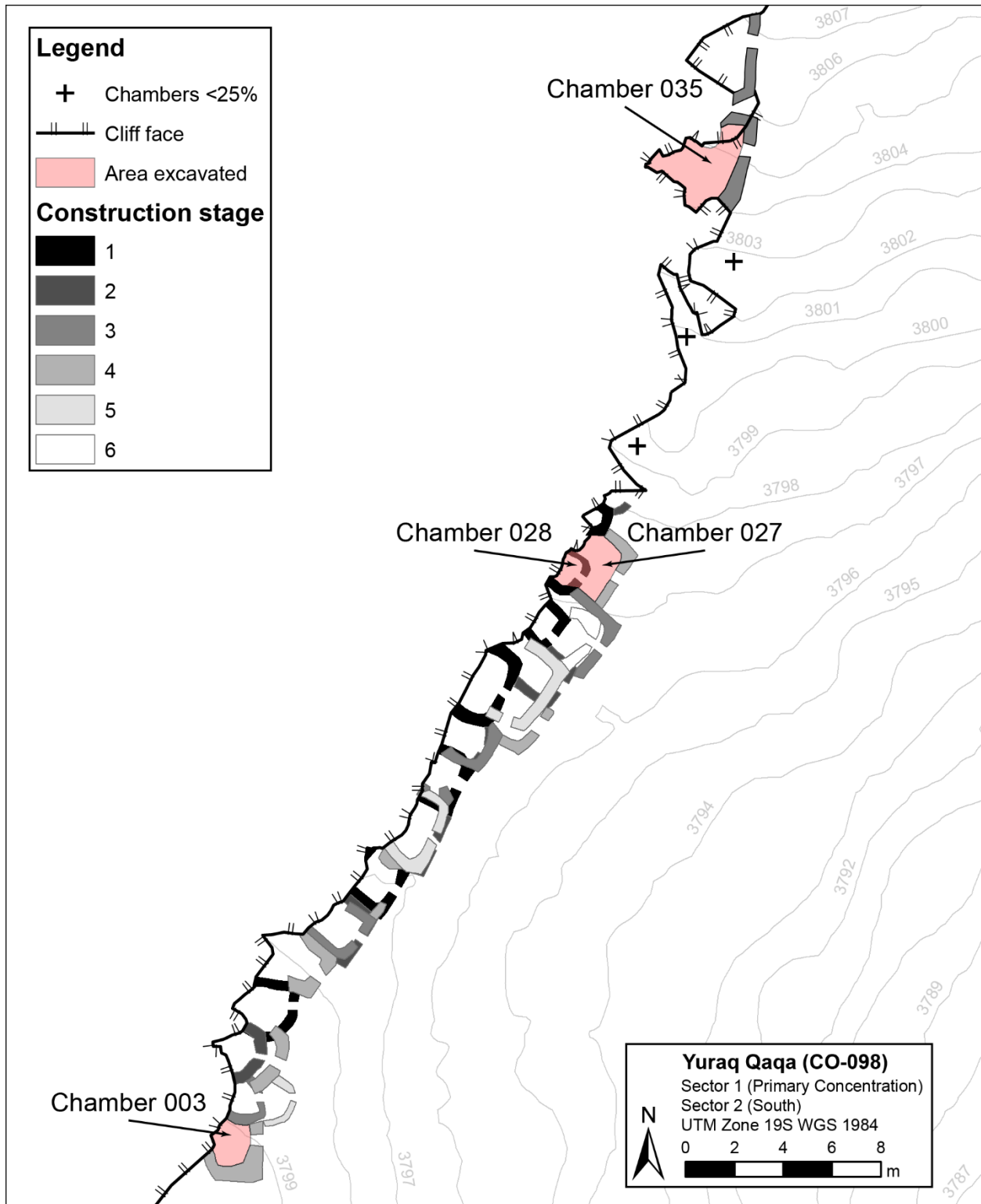


Figure 4.2. Plan view of Sectors I and II, with excavated funerary chambers indicated.

Sector II begins immediately to the north of Sector I but it is not contiguous with the primary concentration. It is also located at a slightly higher elevation (approximately 10 m) than Sector I. Sector II consists of smaller, discontinuous clusters of funerary chambers, organized in two or up to three constructive levels. Only one chamber was excavated in this sector (Chamber 035), but it is the largest funerary structure at the site (3.77 m wide), yielding the second-highest MNI values of any single burial group (Table 4.1; Figure 4.4). Chamber 035 is super-imposed over two smaller chambers that were sealed in antiquity, suggesting that it is a later-phase construction, an interpretation bolstered by two radiocarbon dates from bone that indicate use of the chamber during the 14<sup>th</sup> century (see Appendix A).

Located approximately 70 m to the northeast of Sector II, Sector III is comprised of two clusters of funerary chambers built under rock overhangs. In general, funerary architecture in Sector III is more rustic in nature and haphazard in organization, with a greater use of irregularly-shaped stones. The two chambers excavated in this sector, Chambers 051 and 054, are located approximately 6 m apart on opposite ends of the same cluster. Chamber 051 is a primal structure. Chamber 054 represents a later constructive phase, although its architectural relationship to Chamber 051 cannot be conclusively determined from surface features. Nevertheless, all three radiocarbon dates from this sector fall squarely in the 13<sup>th</sup> century (Table 4.2).

In all, six chambers, or roughly 10% of all funerary structures at the site, were excavated. Cranial MNI for excavated mortuary contexts is 148.<sup>47</sup>

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<sup>47</sup> I estimate that this sample represents anywhere from 12.5-25.0% of all individuals who would have been buried at Yuraq Qaqa during its five centuries of use, if one assumes that each chamber housed an average of 10-20 *capullos*. Clearly, Chamber 035 is an outlier with respect to chamber MNI, which suggests possible admixture from adjacent tombs. This is discussed in Appendix A.



Figure 4.3. Primary concentration of above-ground funerary structures at Yuraq Qaqa (CO-098). Chamber 003 is only partially visible from the surface.



Figure 4.4. Commingled human remains on the surface of Chamber 035.



Figure 4.5. Above-ground funerary structure at Sahuara (CO-118).



Figure 4.6. Commingle human remains in the burial cave at Sahuara (CO-118).



### Sahuara (CO-118)

Sahuara (CO-118) is located only 1 km east of Yuraq Qaqa, but on the opposite side of the Chillihuitira river, an important hydrological boundary that structured *ayllu* landholdings during late prehispanic times (Wernke 2013; see Figure 2.4). It is one of six small clusters of tombs located along the lower western flank of Pampa Finaya, built under rock overhangs or inserted in natural caves. Collectively, these sites are more extensively looted and less elaborate architecturally than Yuraq Qaqa, although little in the way of standing architecture remains. They likely pertained to Kitaplaza (CO-164) and Llanka (CO-127), mid-size agriculturalist villages that were smaller and less internally differentiated than San Antonio (Wernke 2003: 226).

Sahuara (CO-118) itself is located just upslope of an abandoned canal (Wernke 2003). The site consists of at least two chambers built within a natural cave, closed off on its western perimeter by a wall that is no longer visible from the exterior. These structures fall within the spectrum of ‘inserted’ *chullpas* in Doutriaux’s (2004) local typology, being less elaborate than ‘abutted’ *chullpas* from Yuraq Qaqa. The roof of both structures is completely formed by bedrock, utilizing only a few large slabs to close the space between the rock shelter and west wall. The façade of the southernmost chamber exhibits a small trapezoidal opening, formed by two vertical stones and lintel. Above the cave remains a single wall from a mortuary superstructure that visibly marks on the landscape what are otherwise hidden burials (Figure 4.5). Unfortunately, the upper chamber is lacking in skeletal or material culture remains, having been virtually emptied by looters and degraded by erosion and exposure to the elements.

Therefore, excavation targeted the two subterranean chambers, which contained abundant human skeletal material (Figure 4.6). Because of admixture from looting and the partial collapse

of the wall that divided these adjacent chambers, the crania recovered from Sahuara are combined in all analyses. Cranial MNI for the site is 76.

### *Excavation and Coding of Commingled Remains*

A complete description of excavation methodology and system of registry can be found in the technical report of Proyecto Bio-Arqueológico Coporaque (Ferrando Verástegui and Velasco 2014). Because of the unique methodological challenges posed by looted funerary contexts, our excavation strategy was opportunistic, selecting funerary structures that were spatially discrete from one another and contained well-preserved skeletal remains amenable to detailed bioarchaeological analysis. Accessibility and safety was also an important consideration due to partial collapse of some chambers.

In this study, the primary unit of analysis is the “burial group,” consisting of all crania collected or excavated within a given funerary structure. Burial groups are architecturally and spatially discrete and generally correspond to units of excavation—with the sole exception of Chambers 027 and 028, which were excavated as one unit, but with multiple loci (see below). Although looting has resulted in the disarticulation and commingling of individuals, skeletal remains do not appear to have been scattered widely from their original mortuary contexts. Partial destruction of chamber walls may have resulted in the commingling of human remains between adjacent funerary chambers. For example, Chambers 004 and 005, located near the looter’s entrance to Chamber 003, are largely bereft of surface remains; it is possible that skeletal elements from these chambers may have been displaced into Chamber 003. However, admixture between the burial groups defined in this study is unlikely due to their spatial separation. Furthermore, radiometric evidence from both wall mortar and human bone points toward the

relative contemporaneity of funerary structures and the human remains recovered within their confines (Appendix A).

Mortuary contexts at Yuraq Qaqa and Sahuara were excavated using the locus system, which designates discrete areas of soil matrix and the cultural material therein with unique codes. A locus can be arbitrary, stratigraphic, or cultural. The flexibility of this system is ideal for looted tombs, where material is hardly (if ever) arranged in horizontal levels because of structure collapse and anthropogenic disturbance. Each unit of excavation consisted of multiple excavation loci, which are described in detail in Ferrando Verástegui and Velasco (2014). Typically, the first locus of excavation in each unit was dedicated to the collection of surface remains and removal of loose stones from wall or roof collapse. Subsequent loci were defined based on the presence of unique features (e.g., partially intact *capullos*) or changes in soil texture or color. Archaeological materials recovered from each locus were collected in separate bags according to material type and provenience: site, unit, quadrant (if applicable), and locus. A trained physical anthropologist was on hand at each excavation unit to ensure that anatomically associated remains were bagged together.

Because time was scarce and human skeletal material abundant, complete or partially complete crania were the only skeletal elements consistently point plotted (XYZ) on a reference map. All discrete skeletal elements, cranial and postcranial, received a unique bone code that included the locus of provenience followed by a four-digit number distinct to that locus (e.g., 1081.0001). Elements that were anatomically associated with one another were assigned a three-digit articulation code (e.g., A025), which was numbered continuously within the unit and added as a suffix to the end of the bone code of each element comprising the group.

## *Chronology*

Botanical inclusions from wall mortar and human bone were dated to establish the chronological position of these mortuary contexts relative to the period of Inka state formation (Table 4.2). Radiocarbon dates from Yuraq Qaqa, summarized above and presented in full in Appendix A, indicate cemetery use and construction potentially as early as A.D. 1050 and stretching into the first half of the 15<sup>th</sup> century. These results confirm that the “morphogenetic development” of the site (cf. Velasco 2014), a process of continual construction involving horizontal and vertical expansion, occurred across roughly four centuries. At Sahuara, two bone dates from distinct stratigraphic loci at Sahuara fall largely in the 13<sup>th</sup> century A.D. This is consistent with Wernke’s (2003) survey, which only documented a Late Intermediate Period component at CO-118.

To investigate how cranial modification and dietary practices changed over time, the cranial sample was partitioned temporally into “Early LIP” (A.D. 1150-1300) and “Late LIP” (A.D. 1300-1450) based on the radiocarbon dates presented in Table 4.2. This chronological bracketing is supported by architectural data at the site of Yuraq Qaqa and mirrors a similar division used by other scholars in the Andes on the basis of climate change, shifting settlement patterns, and the onset of Inka influence around A.D. 1300 (Arkush 2008; Kosiba 2010).

Only two cranial individuals cannot be securely dated to either the Early LIP or Late LIP because they were recovered from an excavation locus of ambiguous association, located intermediate to Chamber 027 and Chamber 028. These two crania are excluded from all temporal comparisons.

Table 4.2. Radiocarbon (AMS) dates for mortuary contexts used in this study.<sup>a</sup>

Site	Chamber	Sample No.	Material	<sup>14</sup> C age (B.P.)	1σ cal (A.D.)	2σ cal (A.D.)
Yuraq Qaqa	003	C98-1051/86/1	bone	548 ± 20	1412-1434	1404-1442
Yuraq Qaqa	027	C98-3024/1/1	botanical	554 ± 25 <sup>b</sup>	1409-1432	1400-1443
Yuraq Qaqa	028	C98-1028/2/1	bone	868 ± 21	1190-1261	1180-1268
Yuraq Qaqa	028	C98-3028/1/1	botanical	931 ± 25	1150-1206	1046-1219
Yuraq Qaqa	035	C98-1080/14/1	bone	642 ± 20	1321-1397	1311-1404
Yuraq Qaqa	035	C98-1081/83/1	bone	654 ± 23	1318-1394	1301-1400
Yuraq Qaqa	051	C98-1033/9/1	bone	808 ± 20	1230-1278	1225-1281
Yuraq Qaqa	051	C98-3051/1	botanical	796 ± 28	1230-1284	1222-1291
Yuraq Qaqa	054	C98-1058/5/1	bone	784 ± 23	1235-1289	1226-1294
Sahuara	--	C118-2000/4/1	bone	874 ± 20	1185-1227	1177-1266
Sahuara	--	C118-2011/11/1	bone	812 ± 21	1230-1276	1223-1281

<sup>a</sup> See Appendix A for complete table and graphical representation of all radiocarbon dates from project. Dates shaded in gray were designated “Late LIP.”

<sup>b</sup> AMS date represents *terminus post quem* for the construction of Chamber 027.

## Osteological Data Collection Methods

### *Age Estimation*

Standard bioarchaeological techniques were used to estimate age and sex from the cranium and establish a demographic profile (Buikstra and Ubelaker 1994). Subadult age was determined with respect to dental eruption and the fusion of secondary centers of ossification (Scheuer and Black 2000). Adults were categorized as Young Adult (20-35), Middle Adult (35-50), or Old Adult (50+), based on the systematic scoring of ectocranial suture closure patterns, as well as qualitative assessment of dental attrition and antemortem tooth loss (Meindl and Lovejoy 1985). Individuals with high rates (>50%) of tooth loss most likely exceed 50 years of age and were generally assigned to the “OA” category (Mays 2010: 76). All age categories and their corresponding age ranges are listed in (Table 4.3).

The limits of age estimation techniques based on the ectocranial sutures, especially in isolation, are well documented (Brooks 1955; Galera, et al. 1998; Hershkovitz, et al. 1997; Key,

et al. 1994). Cranial vault modification may also undermine the accuracy of cranial methods of age estimation by prematurely advancing suture closure (O'Brien and Sensor 2008). This is an inherent shortcoming when analyzing disassociated skeletal elements, since multifactorial age estimates from complete skeletons could not be attempted. In cases where the cranial and dental evidence conflicted, specimens were conservatively assigned to a wider age categorization (e.g., T/YA, YA/MA, MA/OA). Ultimately, age estimation in this study acknowledges its methodological limitations, as well as observer subjectivity in the weighing of available lines of evidence. It should be noted, however, that age-at-death distributions based on cranial remains are broadly similar to distributions derived from postcranial elements, which indicate an underrepresentation of infants and children in the sample (Appendix B; Velasco 2014).

Table 4.3. Age categories used in analysis.

	Age Category	Age Code	Age range (in years)
Juvenile	Fetus	F	< 0
	Infant	I	0-3
	Child	C	3-12
	Adolescent	T	12-20
Adult	Young Adult	YA	20-35
	Middle Adult	MA	35-50
	Old Adult	OA	50 +

### *Sex Estimation*

Sex estimation was primarily based on the ordinal scoring (1-5) of sexually dimorphic traits of the cranium: nuchal crest, mastoid process, supraorbital margin, and supraorbital ridge/labela (Buikstra and Ubelaker 1994). The mental eminence was considered if the cranium was still associated with a mandible. Overall robusticity and secondary sex characteristics, such as zygomatic breadth and curvature of the frontal, were also taken into

account. In rare cases, associated os coxae were used in tandem with cranial traits for a more accurate estimate. Based on available morphological evidence, individuals were assigned to one of five categories: female (F), probable (F?), ambiguous (?), probable male (M?), and male (M). All individuals <15 years old were scored “sex = indeterminate” since sexually dimorphic traits do not manifest before puberty.

Because of population variation in cranial form and sexual dimorphism, all sex estimates were revised during a second pass through the collection, when the observer was better acquainted with population variation. For example, the nuchal crest rarely exceeds a score of “3” in this highland Andean population, making it less useful for discriminating between males and females. In addition, sex estimates from crania that varied between different stages of data collection were conservatively recoded as either “probable” or “ambiguous.”

### *MNI Determination*

Minimum number of individuals (MNI) reported in this dissertation is based exclusively on cranial elements. Initially, 211 complete or partially complete crania were identified during field excavations as discrete individuals. In the laboratory, cranial fragments from each mortuary context were sorted by age, element, and side. All diagnostic fragments were checked for refits with other fragments in the same or adjacent loci and compared against incomplete crania that had already been assigned a specimen code. Associated fragments were assigned the same code as the cranium with which they refit. Next, fragments or elements that could theoretically pertain to an incomplete cranium were excluded from the MNI count. Finally, single elements (>75%

complete) or groups of elements that represented distinct individuals were assigned new bone codes, increasing the combined MNI count of adults and juveniles to 231.<sup>48</sup>

## Cranial Vault Modification

### *Defining Modification Type: Problems and Prospects*

The categorization of cranial vault modification “types” has been recognized as a source of confusion since its inception as a scientific pursuit (see Munizaga 1987; Tiesler 2014). In their foundational volume on the subject, Dembo and Imbelloni (1938: 240) lamented the lack of a uniform terminology in the early literature and proposed a system of classification that has held sway in the field ever since. Rather than review the history of cranial modification studies, which has been treated at length elsewhere (Tiesler 2014), I examine the broader methodological challenges of cranial modification classification and argue that typologies which conflate form and technique inadequately capture observable variation in the study sample. First, I review Dembo and Imbelloni’s (1938) diagnostic criteria for distinguishing between tabular (fronto-occipital) and annular (circumferential) types and show how this dichotomous approach has been adapted and reformulated, but ultimately conserved, by subsequent research. I focus on classificatory studies in the Andes, but also consider other geographical regions where “hybrid” or “intermediate” forms can shed light on possible sources of variation. These head shapes, which do not strictly conform to either type, continue to generate inconsistencies in the application of a dichotomous system to culturally and temporally diverse skeletal assemblages.

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<sup>48</sup> Small incomplete fragments (<75%) of single elements are not included in the MNI count. For example, a fragmentary R nasal in Chamber 027 would technically increase MNI by 1, but its inclusion in Chamber 027 may be due to admixture of small fragments from the looting or partial collapse of adjacent chambers. Counting these stray fragments would overestimate the number of individuals who were actually buried in a single chamber and thus not reflect a “true” or reasonable tomb MNI.



Dembo and Imbelloni (1938) put forth two overarching classes of modified crania based on form and technique: Tabular (*craneos achatados*), which involves fronto-occipital compression through the use of rigid or flexible boards, and annular (*tipo ayмара*), defined by circumferential constriction and elongation of the cranial vault by way of bandages. The tabular type is further subdivided into two sub-categories depending on the plane and center of compression: “erect” centered on lambda (parietal and occipital) and the “oblique” style centered on inion (occipital squama only). They specify several metrics to distinguish between tabular erect and oblique types, such as the index of occipital curvature and the angle of the occipital clivus relative to vectors plotted on a Klaatsch cranial polygon. Topinard’s general axis of modification, an approximate measure of obliqueness relative to the Frankfurt plane, is also cited as a key diagnostic criterion; the typical oblique cranium exhibits an obliqueness of approximately 120°, while erect crania fall below 100° (Dembo and Imbelloni 1938: 258).

Dembo and Imbelloni (1938: 268-269) recognized that variation exists within each ideal type, due to factors such as age, duration of compression, physical and anatomical properties of the cranium, and material characteristics of the deforming apparatus. As such, they distinguish variants of the tabular type based on the degree of anterior or posterior flattening and specify unique forms, including *bilobate*, *trilobate*, *pseudocircular*, and *mimetic*. Pseudocircular forms are defined as “tabular erects which at first glance are confused with annulars,” due to the use of bands to fasten a child’s head to the cradle board (Dembo and Imbelloni 1938: 273, my translation). Mimetic forms, in which one type presents secondary features that make it similar to another type, are explored in the case of a tabular oblique specimen that is virtually identical to annular in lateral view (Dembo and Imbelloni 1938: Fig. 113). Unfortunately, pseudocircular and mimetic forms are rarely defined consistently by later works, if identified at all, leaving the

impression of a more rigid dichotomy between tabular and annular than the data support (but see Tiesler 2014).

In particular, Weiss (1962: 17-18) criticizes the dichotomous nomenclature of Imbelloni's system as insufficient because it results in notably different crania described using the same terminology. Weiss positions himself against physical anthropologists who analyze deformed crania as "geometric forms" and instead promotes a more culturally-informed approach, which associates different styles with specific cultural groups. He proposes 12 modification types but cautions that no one type should be seen as exclusive to the culture or territory for which it is named. His system also addresses the presence of both circumferential and antero-posterior compression in single types on its own terms, rather than relegating such intermediate forms to the margins of the dominant categories. Unfortunately for the osteologist, Weiss largely circumvents cranial diagnostics of his deformation types, instead relying on molds to provide an overall representation of form. Nevertheless, his contextual approach calls attention to meaningful cultural variation even among deforming styles that employed similar techniques.

Recent research on Andean skeletal populations continues to build upon these early "scientific" and "cultural" approaches to modification, yet a singular systematic approach remains elusive, in no small part due to considerable variation in cranial modification style and technique in just this world region. Taking into account archaeologically recovered deforming apparatuses from southern Peru and northern Chile, Allison et al. (1981) describe 14 types of cranial shapes, although Gerszten et al. (1993) subsume these types into two overarching classes ("boards" and "bandages"), echoing Imbelloni's key distinction. Hoshower et al. (1995) also prioritize deforming technique based on the observation of pad and strap impressions on the frontal and occipital. In their sample, inter-cemetery heterogeneity in pad shape and placement

points to socially meaningful and empirically identifiable variation with the “fronto-occipital” style that does not conform to the typical “tabular” attributes in Dembo and Imbelloni (Dembo and Imbelloni 1938). Similarly, Kurin (2012: 218) argues that circumferential modification varies between males and females in regard to the placement of bindings. In this regard, these studies emphasize technique over general shape in the categorization and interpretation of cranial modification style. Nevertheless, most work in the Andes continues to employ the basic categorical distinctions outlined in Imbelloni (tabular or fronto-occipital, and annular) (Blom 2005; Gerszten 1993; Pechenkina and Delgado 2006; Torres-Rouff 2002).

In tandem with qualitative methods, researchers have developed the scientific-quantitative approach by employing simple multivariate indices and discriminant functions to classify modified versus unmodified crania and distinguish types of cranial modification (Clark, et al. 2007; O'Brien and Stanley 2013; Pomeroy, et al. 2010). Morphometric analyses have also explored patterns of variation in modification style across different regions and time periods to infer the degree to which practices were standardized (Kuzminsky, et al. 2016; Perez 2007). These studies expose the shortcomings of qualitative approaches which are prone to inter-observer bias and where population-specific variation can skew an observer's perception of what constitutes “unmodified” (O'Brien and Stanley 2013). Pomeroy et al. (2010: 331) further suggest that incongruent results from studies which measure the morphological effects of CVM may result from “the use of very broad categories of modification...which subsume considerable variability in cranial shape.” Despite advancing new approaches to the ambiguities of cranial modification categorization, most studies develop discriminant functions within the established norms of visual classification, upholding the basic dichotomy between annular and tabular (O'Brien and Stanley 2013).

The tension between dichotomous classification and a measurable range of variation continues to confound attempts at consistent classification. One particular source of confusion stems from the conflation of deforming apparatus and axis of modification, inherent in Imbelloni's terminology, which equates tabular erect with cradle boards, tabular oblique with free tablets, and annular with bandages or bonnets. Subsequent research challenges, if not completely undermines, such a straightforward correspondence since similar shapes can be achieved by different apparatuses, at the same time that a single apparatus can produce multiple forms depending on how, and for how long, it is fastened (Allison, et al. 1981; Kohn, et al. 1993; Weiss 1962). The difference between a more vertically or obliquely oriented vault may be due to "no more than minor arbitrary differences in the angle at which a board was applied to the infant's head" (Gerszten 1993: 91). Despite the fact that most authors acknowledge an imperfect correspondence of form and technique, there persists the tendency to collapse cranial modification variation into "boards" and "cords," as if isomorphic with a determined shape (Gerszten 1993; O'Brien and Stanley 2013).

Even if we accept the reasonable tenet that tablets or bandages, used exclusively, produce "typical" forms, how does the dichotomous system account for crania where different techniques are used in tandem, as is often the case? The substitution of boards with pads and the use of bindings to hold them in place can produce forms which may be confused with the annular or tabular types at first glance (Munizaga 1987; Stewart 1941; Weiss 1962). These combinatory forms are sometimes called pseudocircular<sup>49</sup> (Cocilovo and Guichón 1994; Munizaga 1987: 115;

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<sup>49</sup> Multiple authors have used the term pseudocircular to refer to slightly different variations on head shaping techniques. As discussed, Dembo and Imbelloni (1938) defined pseudocircular solely as a variant of tabular erect, yet most authors use this term for both oblique and erect varieties (Tiesler 2014). When pseudocircular is used to describe the combination of pads and bands, however, this is not equivalent to the pseudocircular variant from Imbelloni's classification, which still employs rigid boards (Munizaga 1987: 131).

Stewart 1941; Stewart 1943; Tiesler 2014), or fronto-occipital rounded (Blom 1999). Other hybrid forms include crania that exhibit additional planes of compression outside of the typical attributes, such as tabular oblique with flattening at lambda (Tiesler 2014: 75). These are typically approached as varieties rather than as separate types themselves since unique secondary centers of compression on only a handful of crania may actually clarify deforming techniques that did not always leave impressions on all skulls (see Weiss 1962: 19).

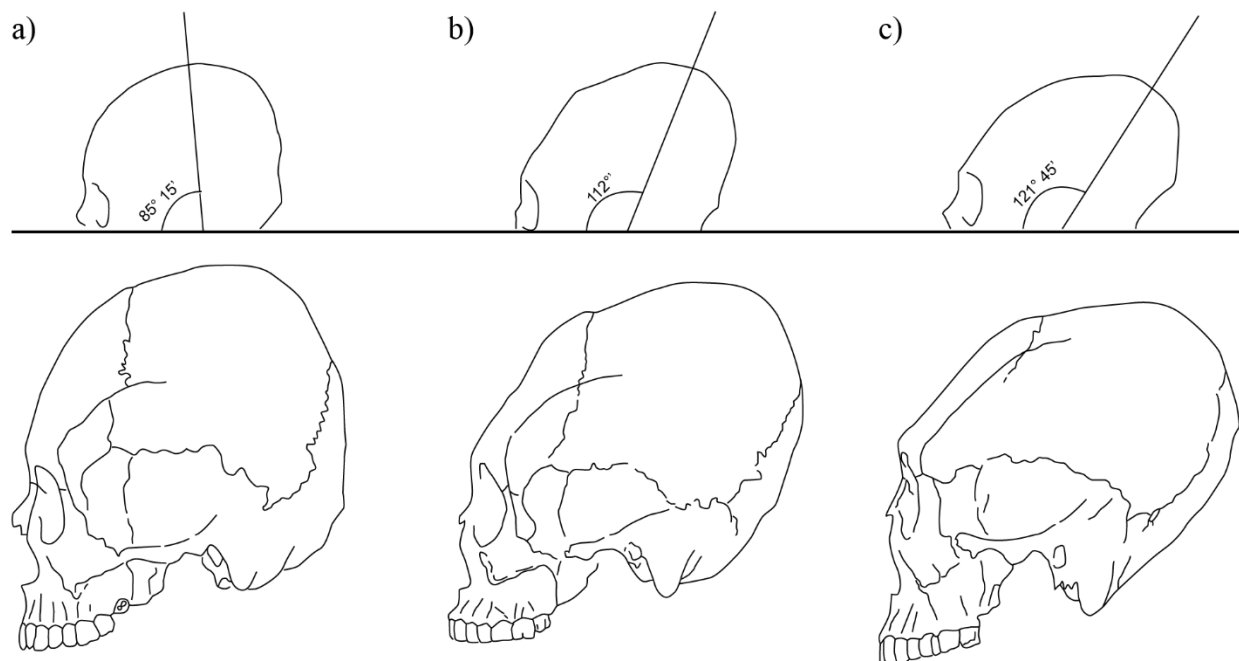


Figure 4.7. Axis, or angle, of modification in three CVM types: (a) tabular erect, (b) intermediate-mimetic, and (c) tabular oblique. Drawings are reproduced and re-composited from Romano (1965): Fig. 31, 32, 43, and 48.

A third problem with the dichotomous scheme relates to axis of modification itself and the fact that the degree of inclination of the cranial vault—how oblique it is relative to the Frankfurt plane—can vary considerably. The gradient of inclination between erect and oblique

gives rise to forms that are intermediate in appearance (Munizaga 1987).<sup>50</sup> Romano's (1965) meticulous classification of 24 crania from Veracruz (Mexico) addresses this issue directly by recording and illustrating the degree of obliqueness of each crania, along with other morphometric variables (Figure 4.7). Although the tabular erect style predominates in the sample, six crania are classified as either oblique or intermediate-mimetic, the latter of which exhibit a slightly oblique vault, occipital flattening of lesser intensity, and evidence of the use of a band in the supra-asterionic region. These crania average an axis of modification of 111°, falling squarely between the typical values for erect and oblique per Imbelloni (90-100° and 120°, respectively). Romano's (1965) detailed, case-by-case descriptions suggests that tabular erect, oblique, and intermediate forms can derive from a common deforming device, with differences arising from its positioning on the posterior vault and the intensity of the deforming process.

The conflation of form and technique in the standard terminology requires that these variables be disaggregated to more accurately describe CVM variation within a given sample. Therefore, I specify modification categories using descriptive terminology and transparent diagnostic criteria, namely *angle* (or, axis of modification) and *compression center*, which allows for crania to be grouped together based on gross morphological similarities, while also recognizing cross-cutting forms of variation that obviate dichotomous classification. Following this protocol, crania classified as erect may exhibit evidence of bindings (e.g., supra-asterionic depressions), but lack direct compression at lambda, whereas the term “tabular erect,” as commonly employed, would preclude these characteristics. By specifying key variants, this approach addresses CVM diversity that would otherwise remain hidden under the traditional

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<sup>50</sup> Dembo and Imbelloni (1938: 276) recognize intermediate forms between “oblique” and “erect” as well, but only within the context of annular forms.

classification and facilitates comparison with other samples in the future. Ultimately, there is no one-size-fits-all-regions methodology, and classificatory methods must be sensitive to local variation and the research question at hand (Blom 1999). As Munizaga (1987: 119) explains, a variant of one type might be considered as a separate category elsewhere because of its cultural importance and ubiquity.

A final issue concerns whether observable differences in cranial form were intended by head shaping practitioners, or due to factors such as practitioner skill or compensatory growth of the skull (Tiesler 2014). Discerning slight intentional modifications from unintentional modification also presents a methodological challenge as the boundary between “modified” and “normal” is rarely discrete, and qualitative assessments may be skewed by samples with high frequencies of modification (Clark, et al. 2007; O'Brien and Stanley 2013: 462). Practices such as adornment or head binding can leave slight impressions or grooves on the cranium, and even if they do not visibly alter the skull in *norma lateralis*, they are nevertheless culturally meaningful and “embodied” (Duncan 2009; Tiesler 2014). Previous studies navigate this epistemological conundrum by focusing solely on cranial modifications that were unequivocally directed at changing the shape of the head (Blom 1999; Tiesler 2014). I adopt this body-centered approach in the present study.

### *General Category*

In this study, crania were assigned to one of four principal categories based on the overall projection of the cranial vault relative to the plane of the neck: Unmodified/Unintentional, Erect, Oblique, and Slight. Variants of the erect and oblique forms, with respect to occipital shape and center of compression, are detailed in Chapter 5. All modification types can be broadly

characterized as “fronto-occipital.” That is, true “annular” forms, defined by broad circumferential constriction of the cranial vault, were not present in the sample. However, the oblique category encompasses some of the morphological characteristics typically associated with annular or circular modification, as described below.

### Unmodified/Unintentional

Given the difficulties in ascertaining intentionality from cranial form, the “unmodified” category encompasses crania whose vault contour does not deviate significantly from normal curvature. The category also includes crania of ambiguous deformation status (e.g., “Unmodified?”), where overall shape is intermediate between “slight” and “normal” (Figure 4.8). Following Clark et al. (2007: 599), crania assigned to this category may exhibit slight depressions or flattening on the frontal and occipital bones, “but not beyond what was determined to be within the realm of normal variation.” Preference is given to overall form since slight alteration to the ectocranial surface can stem from habitual practices, such as adornment or hairbands, which are not necessarily equivalent to head shaping customs (see Tiesler 2014). Because of the morphological continuum between modified and unmodified crania (see Clark, et al. 2007; Pomeroy, et al. 2010), this conservative approach is warranted.

### Oblique

Broadly defined, oblique crania exhibit oblique projection of the cranial vault relative to the plane of the neck, resulting from anterior-posterior compression (Duncan 2009). In the Colca Valley, oblique forms probably involved pads (rather than rigid tablets) placed on the anterior and posterior cranium and fastened with head bindings, similar to what is sometimes called “pseudocircular” (Stewart 1941; 1943), “Tipo Nazca” (Weiss 1962), or Fronto-Occipital Rounded (Blom 1999). Evidence of binding is usually manifested as a horizontal depression



centered on the occipital squama, lateral flattening of the frontal bone, and constriction of the posterior-inferior parietal. Although oblique modification recalls the traditional annular type, crania in this category usually exhibit slight bilateral expansion of the parietals, whereas the vault of a cranium with annular modification tapers postero-superiorly (Antón 1989).

### Erect

Erect crania are identified by anterior-posterior compression parallel to the plane of the neck (Duncan 2009). As used in this study, “erect” is not isomorphic with “tabular erect,” but also includes forms that might be considered pseudocircular (Dembo and Imbelloni 1938). Where appropriate, crania within this category that were unambiguously modified by rigid tablets are treated separately as tabular erect (see Chapter 5).

### Slight

Crania that cannot be confidently classified as erect or oblique (i.e., scored as “erect?”) were assigned to the “slight” category (Figure 4.8-C). By definition, these crania only slightly deviate from the normal curvature of the cranium (Blom 1999). This category is inherently less discrete than the erect or oblique categories because the slight character of modification makes impressions more ambiguous and the axis of modification difficult to measure, if even discernible. It cannot be determined whether the slight morphology of these crania was intentional, or the result of an ideal form that was not achieved. In any event, these specimens evince a clear alteration of cranial shape and are considered culturally modified in the present analysis.



Figure 4.8. Morphological continuum between unmodified and modified crania: (A) Unmodified, (B) Unmodified?, (C) Slight.

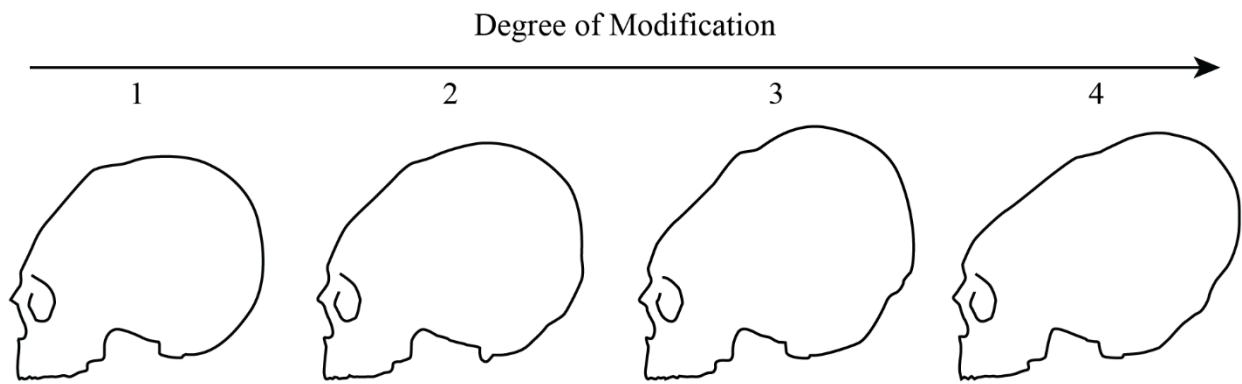


Figure 4.9. Variation in degree of modification among oblique crania (1=slight, 2=moderate, 3=prominent, 4=severe).

### *Degree*

Degree of modification refers to differences in the intensity of modification independent of overall form (Dembo and Imbelloni 1938). For each modification type, crania were scored from slight to severe on a scale of 1-4 (Figure 4.9). In addition to this qualitative assessment, five vault measurements were taken and converted to simple indices to measure the severity of modification in the anterior-posterior and medial-lateral dimensions.<sup>51</sup> Cranial chords were

<sup>51</sup> The following measurements were collected (na = nasion, b = bregma, l = lambda, o = opisthion): Maximum height, Maximum length, Maximum breadth, Chord (na-b), Chord (b-l), Chord (l-o), Arc (na-b), Arc (b-l), Arc (l-o).

measured using Paleotech student spreading calipers. Arc measurements were taken using a flexible tailor tape measure. All measurements were recorded to the nearest millimeter. Arc and chord measurements were used to calculate Kurin's (2012) "modification ratio", which measures the superior and posterior projection of the cranial vault ("elongatedness") as a continuous variable: the lower the ratio, the more pronounced a cranium's departure from normal variation.<sup>52</sup>

### *Impressions and Secondary Points of Pressure*

Impressions on the frontal and occipital bones were scored with regard to degree of contour change (curved, flat, or depression), as well as the position and orientation of impressions, to facilitate the definition of type variants (see Appendix C). Pad shape is not considered because it was judged to be too difficult to score objectively in most cases where impressions are faint (cf. Blom 1999). Beyond evidence of compression on the frontal and occipital/lambda, "secondary" points of pressure were recorded to explore variation in CVM morphology and technique. These secondary sites include the postero-inferior parietal around asterion ("supra-asterionic depression"), the superior parietal above euryon ("superior parietal impression"), and the posterior midline around obelion ("obelionic depression") (Figure 5.5). Attributes such as pre-bregmatic eminence and post-coronal sulcus were also recorded, but are not analyzed here since they represent secondary effects of modification and are not useful diagnostic characteristics (Dembo and Imbelloni 1938; Tiesler 2014).<sup>53</sup>

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<sup>52</sup> Modification ratio =  $\frac{([\text{Arc}(\text{na-b})]/[\text{Chord}(\text{na-b})]) * ([\text{Arc}(\text{l-o})]/[\text{Chord}(\text{l-o})])}{([\text{Arc}(\text{b-l})]/[\text{Chord}(\text{b-l})])}$

<sup>53</sup> See Tiesler's (2014: 43) diagnosis of post-coronal depressions: "Far from being produced by any cultural binding, these depressions are really the end product of growth tensions and assimilation that occur when each side of a suture expands at a distinctive pace."

## Biodistance Analysis

### *Trait Selection, Scoring, and Dichotomization*

This study utilizes cranial non-metric traits to test that hypothesis that burial groups were biologically differentiated. Cranial non-metrics were selected in lieu of cranial metrics and dental data classes because of the excellent preservation of cranial remains at Yuraq Qaqa and Sahuara. Cranial non-metric data are cost effective to collect and can be observed on incomplete cranium, maximizing sample sizes (Buikstra 1976). In addition, when large suites of traits are used, cranial non-metric analyses appear robust to the potential skewing effects of CVM (Del Papa and Perez 2007; Konigsberg, et al. 1993). Conversely, multiple independent studies have demonstrated the impact of modification on craniofacial dimensions, limiting the utility of cranial measurements for inferring biological relationships (Antón 1989; Cheverud, et al. 1992; Kohn, et al. 1993; but see Bethard 2013).

Although dental traits are less susceptible than cranial traits to environmental influences, high rates of dental wear and post-mortem tooth loss in the study sample are a significant limitation, which would result in a preponderance of missing values in the data matrix for biodistance analysis. Heritability studies only exist for a subset of cranial non-metric traits (see Hauser and De Stefano 1989). Nevertheless, biological distance analysis of cranial non-metric traits makes the assumption that phenotype reflects underlying genotype, an assumption bolstered by studies that demonstrate a correspondence between results derived from both morphological and genetic data, as well as research on epigenetic traits in non-human animals (Cheverud and Buikstra 1981; Ricaut, et al. 2010).

Data were collected on 46 cranial and mandibular non-metric traits to test the hypothesis of biological differentiation between mortuary contexts (Table 4.4). I selected traits which had

been employed in previous biodistance analyses in the Andes, to make the Colca Valley dataset amenable to future inter-regional population comparisons (Blom 1999; Sutter and Mertz 2004).

A preliminary trait list was compiled from these sources, in consultation with disciplinary standards (Buikstra and Ubelaker 1994), and then subsequently edited to include additional discrete traits, which were observed in the collection during skeletal inventory (Table 4.4).<sup>54</sup>

Traits that are difficult to observe or score consistently (e.g., internal vault traits, highest nuchal line) and whose variants are not clearly defined in reference texts were excluded from the preliminary list (Corruccini 1974; Hauser and De Stefano 1989). The present study also follows Ossenberg (1970) in scoring supraorbital and supratrochlear foramen separately and further distinguishes between notches and foramina at these two positions.<sup>55</sup>

Scoring protocols were derived from Hauser and DeStefano (1989) and Buikstra and Ubelaker (1994) (see Appendix C). Most traits were initially scored as multi-state variables to record variation in number, size, and morphology. Of particular concern were traits that required that patency be confirmed or size measured with a probe of standard size. Initially, only 1.0 mm and 0.3 mm fishing lines were used for this task, which correspond to “large” and “small” foramina respectively (cf. Hauser and De Stefano 1989). In 2014, it was determined that thinner, more flexible materials, such as brush filaments and thin electrical wire, were more suitable for probing small foramina to confirm that they were not “false” foramina. Crania from excavation

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<sup>54</sup> These additional traits (occipital foramen, squamomastoid suture, and marginal tubercle) are well defined and easy-to-score based on published illustrations and photographs of trait variants in Hauser and DeStefano (1989) and the medical literature.

<sup>55</sup> The treatment of supraosseous structures in nonmetric analyses is quite variable and inconsistent; some authors differentiate supraorbital foramina by position, while others pool together foramina or even notches and foramina (Hauser and DeStefano 1989: 16). Unlike other investigators (Berry and Berry 1967; Prowse and Lovell 1996; Sutter and Mertz 2004), I do not score the frontal foramen (i.e., a laterally positioned supraorbital foramen) as a distinct trait, but follow the *Standards* scoring procedure which includes “multiple foramina.” The present study only differentiates between foramina/notches on the horizontal aspect of the orbit (supraorbital) and those at the confluence of the horizontal and vertical aspects (supratrochlear) (Ossenberg 1970).

locus 1081 that were analyzed in 2013 were re-scored for the variables which would have been affected by this change of protocol.

In keeping with the majority of cranial non-metric studies in the Andes (Blom 1999; Pink 2013; Sutter and Mertz 2004), the complete data matrix of ordinal variables was dichotomized into presence and absence for statistical analysis. Although data dichotomization has been criticized because of the inherent ambiguity in determining presence versus absence, as well as the potential loss of biologically relevant information (Corruccini 1974; Harris 2008), I dichotomize non-metric scores to reduce error and to accommodate the parameters of the multivariate statistics used in this study to estimate biological relatedness. My criteria for determining present versus absent are detailed in Appendix C. As a general rule, the scoring rubric does not consider “trace” expressions as present. Partial and complete expressions of traits are collapsed as present, as Buikstra (1976: 49) has argued that these are “really phenotypic expressions of the same or closely similar genotypes” (see also Prowse and Lovell 1996).

For bilateral traits, the individual count method of Scott and Turner (1997) was used, in which the maximal expression of a trait, regardless of the side of expression, is counted for each individual. This method was selected instead of analyzing a single side arbitrarily because it maximizes the number of traits observable on fragmentary or weathered crania. Individual count is also preferable to the side-count method (cf. Ossenberg 1981; Prowse and Lovell 1996), which can artificially inflate the influence of a trait which is expressed symmetrically.

Table 4.4. Cranial non-metric traits observed in this study.

	Trait	Abbreviation
1	Metopic Suture	METSUT
2	Supraorbital foramen	SOF
3	Supraorbital notch	SON
4	Supratrochlear foramen	STF

	Trait	Abbreviation
5	Supratrochlear notch	STN
6	Infraorbital suture	IOSUT
7	Multiple infraorbital foramina	IOF
8	Anterior ethmoid foramen exsutural	AEFE
9	Posterior ethmoid foramen absent	PEFA
10	Zygomaxillary tuberosity	ZYMAX
11	Marginal tubercle	MRGTUB
12	Multiple zygomatico-facial foramina	MZYF
13	Os Japon	OSJAP
14	Fronto-temporal articulation	FTA
15	Epipteric bone	EB
16	Auditory torus	AT
17	Mastoid foramen	MASTFOR
18	Squamomastoid suture	SQMMAST
19	Parietal notch bone	PNB
20	Asteronic bone	AB
21	Ossicle at occipito-mastoid suture	OSSOMS
22	Parietal foramen	PF
23	Coronal ossicles	COROSS
24	Ossicle at bregma	OB
25	Sagittal ossicles	SAGOSS
26	Ossicle at lambda (apical bone)	OL
27	Lambdoidal ossicles	LO
28	Inca bone	OSINC
29	Occipital foramen	OCCFOR
30	Condylar canal patent	PCF
31	Condylar facet double	CONDFAC
32	Paramastoid process	PP
33	Precondylar tubercle	PRECONTUB
34	Divided hypoglossal canal	DHC
35	Foramen ovale incomplete	FOROVA
36	Foreman spinosum incomplete	FORSPI
37	Foramen of Vesalius	FORVES
38	Pterygo-spinous bridge	PSB
39	Pterygo-alar bridge	PAB
40	Tympanic dehiscence	TD
41	Accessory lesser palatine foramina	ALPF
42	Palatine torus	PT
43	Maxillary torus	MT
44	Mental foramen	MENTFOR
45	Mandibular torus	MANTOR
46	Mylohyoid bridge	MYLBRG

### *Data Screening*

Prior to pooling samples for analysis, it is essential that traits are screened for associations with sex, age, and one another, which might otherwise confound results. The influence of modification type and degree on the expression of cranial non-metric traits is also explored. Because crania and mandibles are only associated in 27 of 151 adult crania, mandibular traits were excluded from the present study. In addition to correlations with age, sex, and CVM, the dichotomized data matrix was examined for inter-trait correlations, which must be accounted for prior to the calculation of the Mean Measure of Divergence (see below).

### *Age and Sex*

Cranial non-metric studies vary in their theoretical and statistical approaches to accounting for age- and sex-related variation in the expression of discrete traits. Following Berry and Berry's (1967) finding that there was no difference in trait incidence between sexes across a large, multi-regional sample, many early studies assumed the influence of sexual dimorphism to be minimal and omitted formal testing. Corruccini (1974) criticized this approach, which potentially mutes inter-population differences by pooling all samples, and showed significant sex correlations in the Terry Collection for which "race," sex, and age are known. He recommends that non-metric analysis be carried out separately for males and females, as is usually done in craniometric studies, but this is not reasonable for the present study because of small sample sizes.

Although there exists a general association of hyperostotic and hypostotic traits with males and females, respectively (Hauser and De Stefano 1989), it is nevertheless important to test associations on a case-by-case basis because of population variability (Buikstra 1976). In this



study, I analyze sex associations using the phi coefficient and related chi-square test to determine strength and significance of association between binary variables. Because of questions of accuracy, sex estimations of “probable male” (M?) and “probable female” (F?) were excluded from the binary variable used to test sex dependence of non-metric traits. Because data screening for a sex effect involves multiple comparisons, the Bonferroni correction was used to set the alpha level for statistical significance ( $0.05 / 38 = 0.001$ ). This value was conservatively increased to 0.005, such that the threshold could be defined as “at or near the 0.001-level.” Following Blom (1999: 135), traits associated at  $p < 0.05$  were only removed if the associated trait “had formerly been identified as sexually dimorphic in other populations.”

With regard to ontogenetic variation, I follow disciplinary standards by excluding juveniles from the analysis since several hypostotic traits, such as tympanic dehiscence, are strongly correlated with juvenile growth development (Brown 2013; Buikstra 1976; Torres-Rouff, et al. 2013). While non-metric variation among children is a potentially fruitful avenue for further investigation into the kinship structure of Colca Valley cemeteries, the present study only considers trait persistence into adulthood in order to eliminate developmental age bias. Some authors argue that it is justifiable to include age-correlated traits among adults if the populations under comparison exhibit similar age-at-death profiles (Buikstra 1976), while others disregard age correlation altogether (Berry and Berry 1967; Ossenberg 1970). Clearly, some traits may be susceptible to age-progression or age-regression, as in the case of vault ossicles which are less likely to be observed as sutural obliteration progresses (see discussion in Buikstra 1976). To identify age-progressive or age-regressive traits, age categories (YA, YA/MA, MA, MA/OA, and OA) were recoded as a five-stage ordinal variable and its rank correlation with trait presence and absence was tested using the Spearman’s rho (Corruccini 1974). As with sex, traits significantly

correlated with age at the 0.05 level were only eliminated if there was precedence in the literature.

### *Cranial Vault Modification*

The influence of cranial vault modification on metric and non-metric variation is of special concern to biodistance research in the Andes, where it is not uncommon for modification frequency to exceed fifty percent within a sample, making recommendations to exclude deformed crania from analysis unreasonable (Bethard 2013; cf. Ossenberg 1970). This study uses non-metric biodistance data rather than craniometric data in part because the former have been shown to be less significantly affected by cranial modification (Del Papa and Perez 2007; Konigsberg, et al. 1993). Inter-population distance matrices calculated for samples with and without deformed skulls generally match, suggesting that the use of multiple traits in tandem can override any skewing effect.

Nevertheless, particular discrete traits, and especially wormian bones, appear to be more susceptible to differential expression related to CVM because of their post-natal development (Konigsberg, et al. 1993; Van Arsdale and Clark 2012), which has led some researchers to exclude vault ossicles a priori (Torres-Rouff, et al. 2013). Ultimately, genetic and environmental differences between populations, as well as regional variation in the type and intensity of CVM, means that a suite of traits vetted in one context (i.e., shown to be relatively unaffected by CVM) cannot be applied to another (Cheverud, et al. 1992; Del Papa and Perez 2007; Rhode and Arriaza 2006; Van Arsdale and Clark 2012). Accordingly, the present study uses the chi-square statistic to test the null hypothesis that CVM presence (modified vs. unmodified) or type (erect, oblique, slight, unmodified), and the presence or absence of a given trait, are independent of one

another. The effect of modification degree on the expression of non-metric traits was also assessed using Spearman's rho.

#### *Intra-Observer Error*

Because of the subjectivity involved in selecting, defining, scoring and dichotomizing non-metric traits, cranial non-metric data sets compiled by different observers are rarely directly comparable (De Stefano, et al. 1984). This study avoids the pitfall of inter-observer error because all non-metric traits were observed and recorded by the author. Intra-observer error, however, remains a concern especially since non-metric data were recorded across multiple field sessions (Molto 1979). Therefore, a subsample of crania from Yuraq Qaqa (N = 22) were re-scored approximately 6 months after the primary session of cranial non-metric data collection to quantify intra-observer error. The Pearson chi-square test was used to check for independence between the two scoring sessions. Only trait scores for the left side of the cranium were used. Statistical significance indicate that the first and second session scores are significantly correlated with one another (i.e., *not* independent) (Pink 2013).

#### *Inter-Trait Correlation*

Although some cranial non-metric studies dismiss inter-trait correlation as having a minimal effect on biological distances (Berry and Berry 1967; Birkby 1982; Corruccini 1974; Ortner and Corruccini 1976; Prowse and Lovell 1996; Spence 1974), the inclusion of inter-correlated traits can artificially inflate similarities or differences between samples by introducing redundancy into the biodistance data matrix (Brown 2013). Recently, Brown (2013: 97) analyzed inter-trait correlations among a large sample of 477 individuals from the Ain Tirghi and Kellis

cemeteries in the Dahkleh Oasis (Egypt), showing that they occur “at a level significantly higher than chance” and therefore must be accounted for in biodistance research design. Furthermore, because MMD (the multivariate statistic employed in this study) is highly sensitive to such associations, inter-correlated traits should be removed prior to statistical analysis (Harris and Sjøvold 2004). Conversely, Sutter (1997: 161) argues that the elimination of inter-correlated traits “may result in the removal of exactly those variables that help to discriminate among the sites.” Ultimately, inter-trait correlations vary across populations and, like age, sex, and CVM, should be evaluated on a case-by-case basis (Brown 2013; Hanihara and Ishida 2001a; 2001b; 2001c; 2001d).

Inter-trait correlations were explored using the Phi coefficient, rather than a simple chi-square test, because the latter “does not provide any information about the strength of any association between traits” (Brown 2013: 59). An important consideration when interpreting statistical significance of inter-trait correlations is Type I (or ‘false positive’) error. Given the number of pairwise comparisons involved in testing for inter-trait correlation (703 in this study), 35 correlations are expected by to be significant at the 0.05 level by chance alone. Therefore, only traits which were highly correlated at a significance level of  $p < 0.001$  are uncritically removed from analysis. For traits significantly correlated at the 0.01 and 0.05 level, they were only eliminated if a) the association was strong ( $\phi > 0.5$ ); b) there exists an underlying rationale for their association, i.e., a common regional origin or similar developmental phenomenon (see Molto 1983); or c) the same correlation is known for larger samples, which can help determine if it is a real biological correlation and not a statistical artifact of multiple comparisons (Harris and Sjøvold 2004).

## *Statistical Methods*

There are a number of statistical formulae by which biodistance studies attempt to quantify biological similarity or dissimilarity, and it is at the discretion of the investigator to choose the tests that are most appropriate according to data type, sample size, and other analytical parameters. Statistical analyses of skeletal non-metric and metric data are generally characterized as either model-free or model-bound, depending on whether or not they incorporate formal population genetic models to estimate genetic variance (Relethford and Lees 1982). Model-free approaches to biodistance analysis can quantify differentiation and provide relative measures of within-group and between-group homogeneity, but outside of the parameters of population genetics. Because model-bound approaches have been primarily developed for metric data (but see Irish 2010), a more traditional model-free approach is employed here, in which measures of phenotypic difference and similarity are compared against other lines of demographic and mortuary data to infer cemetery kinship structure. Model-free methods circumvent the difficult assumptions about population structure that typically fall outside of the purview of archaeological data and better accommodate the small sample sizes and “local” scale of the present study. Specifically, I calculate Mean Measure of Divergence (MMD) between burial groups to test intracemetery biological differentiation and Jaccard coefficients to characterize patterns of within and among-group homogeneity and assess the possibility of extra-local gene flow patterned by sex.

### Mean Measure of Divergence (MMD)

C.A.B. Smith’s Mean Measure of Divergence (MMD), a distance statistic originally developed to measure phenetic divergence across multiple generations of laboratory mice, has been used for decades in biodistance research to measure dissimilarity among groups according

to variation in non-metric trait frequencies. The statistic calculates a measure of divergence (MD) between two groups for each dichotomous variable, or trait, and then all MD values are averaged to obtain the MMD. This value is adjusted to account for differences in the variance of trait frequencies between samples due to sample size fluctuations. Larger MMD values imply greater divergence, while values near zero or negative indicate that either trait frequencies are similar between two samples or sample sizes are too small to detect a meaningful difference. MMD is not an absolute measure (i.e., it cannot be compared between studies), but relative to the number of traits and samples selected for analysis (Harris and Sjøvold 2004). An MMD that is more than twice its standard deviation is used to reject at the 0.05 level of significance the null hypothesis that two samples are from the same biological population.

Although more commonly employed in multi-regional comparisons of biological populations, MMD is conceptually applicable to intracemetery and intraregional analyses as a means to quantify and test the significance of biological differences between subgroups defined a priori. Buikstra's foundational (1976) biodistance study for the Illinois Valley Hopewell employed MMD to examine differentiation between spatially distinct burial mound groups in a single valley. Birkby (1982) follows a similar research design, utilizing MMD to quantify divergence between two cemeteries from the same region. At this scale of analysis, statistically significant MMD values would indicate 1) that samples represent distinct "breeding groups" cohabiting a single region, or 2) that samples derive from temporally distinct skeletal "populations" (Birkby 1982; Harris and Sjøvold 2004).

Despite its ubiquity in the biodistance literature, the statistic has been irregularly applied and mathematically modified over time, leading to confusion at best and erroneous applications at worst (Harris and Sjøvold 2004; Irish 2010). Scholars have been quick to point out its

methodological shortcomings since MMD is strongly subject to bias in trait selection and variable dichotomization, which can potentially distort biologically important variation and produce radically different distance matrices (Harris 2008; Harris and Sjøvold 2004). The appropriateness of the statistic has also been challenged on conceptual grounds, since MMD was “not developed to be a measure of phenetic distance” (Harris 2008: 45). Harris and Sjøvold (2004) further stress that “the meaning of a ‘significant’ difference is quite vague biologically” because samples separated by time or space are by definition distinct populations, and so a significance test only restates the obvious.

Nevertheless, recent studies demonstrate that MMD produces results comparable to other distance measures, such as Mahalanobis  $D^2$  (Irish 2010; Nikita, et al. 2012; Torres-Rouff, et al. 2013). Irish (2010) mounts an exhaustive defense for its continued use by emphasizing how MMD not only accommodates small sample sizes but also missing data since it calculates divergence from summary frequency data. On the other hand, incomplete or small data sets can distort the calculation of tetrachoric correlations for Mahalanobis  $D^2$ , suggesting that “MMD may be the more robust statistic” under certain conditions (Irish 2010: 390). These strengths are especially advantageous for the small and incomplete samples characteristic of archaeological research.

In this study, MMD matrices will be calculated using the R script by Sołtysiak (2011) with Anscombe’s transformation of trait frequencies, which resolves unwarranted changes to the formula over the years (Harris and Sjøvold 2004). The Anscombe formula is a correction term to stabilize sampling variance for sample sizes as small as  $N = 10$ , although very small samples ( $N < 15$ ) can result in spurious distance measures (see Sjøvold 1977). Nevertheless, all provenienced samples are included in the present study, and results will be interpreted in light of

this limitation. Because MMD is highly sensitive to trait selection, Harris and Sjøvold (2004) advise that univariate results be screened prior to multivariate analysis to determine which traits help discriminate between groups. Fisher's exact tests were conducted on trait proportions for all 10 burial group combinations to identify contributory traits, defined as those "showing a statistically significant difference between at least one pair of the groups being evaluated" (Harris and Sjøvold 2004). In the present study, the MMD statistic will be run with and without non-discriminatory traits included in the data matrix, to investigate how results are affected by different parameters and data screening protocols.

### Jaccard coefficients

The calculation of Jaccard coefficients is a relatively straightforward method for measuring inter-sample similarity or difference ( $= 1 - \text{Jaccard}$ ) from dichotomous data. For the study of cranial non-metric traits, the Jaccard method characterizes how phenotypically similar two skeletons are across multiple traits, and then sums the coefficients of multiple comparisons to obtain an overall measure of within- and between-group similarity, as a proxy of genetic homogeneity (Duncan 2011; Spence 1974). The Jaccard coefficient is calculated by counting the number of positive 'matches' between two samples (i.e., the presence of a trait on both crania) and dividing it by the number of total potential matches (positive matches plus non-matches). The shared absence of a trait is not counted in either the numerator or denominator (see Spence 1974: 266).

Because the denominator varies for each inter-individual comparison due to unobservable traits, Jaccard coefficients should not be averaged within or between groups, but rather summed as fractions (i.e., sum of numerators divided by sum of denominators). Two cumulative indices of similarities were employed in this study: the Triangular Cumulative Similarity (TCS) and



Squared Cumulative Similarity (SCS). TCS calculates the number of times two individuals within a group share a given trait, and then sums the resulting coefficients from all pairwise comparisons to measure overall similarity within a group. SCS is mathematically equivalent to TCS, except that it only compares individuals from different groups to one another to measure between-group similarity. TCS and SCS are calculated for all burial groups. If the SCS value between groups is lower than their respective TCS values, it can be inferred that individuals buried together are more phenotypical similar than those buried apart from one another (Duncan 2011; Spence 1974). TCS is also calculated for males and females, by burial group and site, to evaluate models of sex-based postmarital residence, which predict greater heterogeneity within the migratory sex (Spence 1974).

## Stable Isotope Analysis

### *Sampling Strategy*

In the field laboratory, bone samples were extracted from well-preserved human crania and exported to the United States, with permission from the Ministry of Culture of Peru (RVM No. 077-2014). Depending on preservation and accessibility (due to the presence of soft tissue), extraction protocols targeted the following skeletal elements, in order of preference: vomer, cervical vertebra (neural arch), and styloid process. The vomer and styloid process were typically extracted manually or with the aid of sterilized dental tools. A dremel tool was used to cut bone from the neural arch of a cervical vertebra that was anatomically associated with a cranium, to allow cross-reference between stable isotope data and other classes of cranial data analyzed in the present study.

For the present study, only adult bone collagen was sampled for dietary isotope analysis. A stratified, non-random sampling strategy was employed to yield a 30% sample of adults (N = 46) that was representative of the demographic distribution and CVM profile of each mortuary context. For each mortuary context, sample “slots” were proportionally allocated to different modification types (Erect, Oblique, Slight, and Unmodified). Within each modification type, an attempt was made to select both male and female specimens, if available. For this preliminary analysis, only specimens from unambiguously sexed individuals were used. If multiple samples met the sampling criteria for a given mortuary context, the larger sample by weight was selected.

### *Chemical Preparation*

Collagen extraction was conducted in the Bioarchaeology Isotope Research Lab at Vanderbilt University. From each individual selected for analysis, approximately 175 mg of bone was sampled, cleaned with ultrapure water, crushed into 1-2mm chunks, and placed in a glass vial. Samples were soaked in 0.5 N hydrochloric acid (HCl) at room temperature to demineralize the apatite and produce a collagen pseudomorph. After 24-36 hours in the HCl, samples were rinsed thoroughly five times with ultrapure water. To remove humic contaminants, a 1.0 M solution of sodium hydroxide (NaOH) was added to each vial for 30 minutes. After five rinses to remove humic extract, samples were sonicated for 30 minutes in a solution of chloroform, methanol, and water (1.0:2.0:0.8) to remove lipids, which are thought to yield  $\delta^{13}\text{C}$  values that are lower than collagen (but see Liden, et al. 1995). The lipid extraction step was repeated until the process yielded a “clear” solution, and then samples were rinsed five times. To ensure complete removal of inorganic content, an additional HCl soak (30 minutes) and rinse (5x) was included in the chemical preparation protocol (R. Feranec, personal communication). Next, a

diluted solution of 0.01 N HCl was added to the vials and set to heat in a dry bath for exactly 18 hours at 58°C. In the final step, samples were vacuum-filtered into an Erlenmeyer flask using a Whatman filter, placed in acid-cleaned vials, frozen, and freeze-dried.

Collagen samples were shipped to the University of Wyoming Stable Isotope Facility for mass spectrometric measurement, where they were analyzed using a Costech 4010 Elemental Analyzer coupled to a Thermo Delta Plus XP IRMS. Atomic C:N ratios and %Nitrogen and %Carbon are used to assess diagenesis. Resulting  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values are reported in parts per thousand (per mil) with respect to VPDB and AIR, respectively. Standard statistical methods (e.g., Mann-Whitney U) will test if mean values significantly differ by burial group, sex, and CVM.

## Summary

A total of 231 cranial individuals were recovered from two mortuary sites located in the central Colca Valley, Yuraq Qaqa (CO-098) and Sahuara (CO-118). Radiocarbon dating of bone and botanical inclusions from wall mortar used in mortuary construction permit the skeletal sample to be divided into two temporal groups: Early LIP (A.D. 1150-1300) and Late LIP (A.D. 1300-1450). Because looting and commingling prevent the reconstruction of complete skeletons, the cranium constitutes the primary unit of analysis. Three primary lines of bioarchaeological evidence are used to examine the biosocial identities of the individuals buried in above-ground funerary structures: cranial vault modification (CVM), biological distance analysis, and stable isotope analysis of diet.

For CVM, a methodological approach that prioritizes overall shape rather than technique is employed due to ambiguities in coding and inferring the latter. In addition, variation in degree

of modification, angle of modification, and center of compression are explored to nuance the traditional “annular” vs. “tabular” dichotomy used in the Andes. For biological distance analysis, cranial non-metric traits were used since they are more robust to skewing effects of CVM, relative to cranial metrics. High rates of tooth loss, dental wear, and disassociation between crania and mandibles make dental metrics and non-metrics less optimal data classes for the present biodistance study. Between-group and within-group phenotypic variability are respectively analyzed using the Mean Measure of Divergence (MMD) distance statistic and Jaccard coefficients. For stable isotope analysis, carbon and nitrogen isotopes are used to characterize the protein component of adult diet. A representative sample of 46 individuals, constituting 30% of all adults (N = 154), were selected for isotope analysis. Resulting carbon and nitrogen isotope ratios will be analyzed using standard statistical methods.

## CHAPTER 5

### CRANIAL VAULT MODIFICATION

*“Estos Collaguas...traían en la cabeza unos que llamaban en su lengua chucos, a manera de sombreros muy altos sin falda ninguna, y para que se pudiesen tener en la cabeza, se la apretaban a los niños recién nacidos tan reciamente, que se la ahusaban y adelgazaban alta y prolongada lo más que podían, para memoria que habían las cabezas de tener la forma alta del volcán de donde salieron....Estos [Cavanas] son muy diferentes en la cabeza a los Collaguas, porque, recién nacidos los niños e niñas, se la atan muy recio y la hacen chata y ancha...”*

Juan de Ulloa Mogollón, Relación de la Provincia de Los Collaguas (1586)

In his description of the Colca Valley and its inhabitants, Ulloa Mogollón presents the peculiar head shaping rituals practiced by the two main groups of the valley as emblematic of their ethnic identity: the upper-valley Collaguas made their heads long and narrow, while the lower-valley Cabanas made their heads squat and wide—two distinct forms with the similar goal of embodying their respective mountain progenitors. Although the Collaguas and Cabanas have been cited as a classic example of ethnic identity marking in the late prehispanic Andes (Blom 2005; Tiesler 2014), the time depth of this cultural practice in the Colca Valley, and its standardization across society during the late prehispanic era, are not well understood (Wernke 2014: 60).

This chapter addresses Ulloa’s claims through the systematic analysis of modified skulls from systematically excavated mortuary contexts. Rather than adopt *a priori* the annular vs. tabular dichotomy commonly employed by physical anthropologists and echoed by the Spanish

chroniclers, this chapter first explores cranial vault modification (CVM) in the Colca Valley on its own terms, assessing homogeneity in form and the consistency with which the “ideal” types were achieved. Variability in CVM is then compared against demographic categories to assess potential age- or sex-related differences. Primary results on overall CVM frequency and distribution of modification types are reported for the seven mortuary contexts excavated as part of this study, as well as for broad temporal categories (Early LIP vs. Late LIP), based on the radiometric data reported in Chapter 4. In the discussion, results from the Colca Valley are compared to other regional studies of CVM to assess relative standardization and change across time. Finally, this chapter compares inter- and intra-site variation in the presence and types of CVM against the expected outcomes of the corporate group and inter-group alliance models.

## Results

Compared to the broad characterization of Collagua head shape found in the ethnohistoric documents, bioarchaeological data reveal that modification practices were not uniform among the upper valley population. Forty-three percent of all crania for which head shape could be determined (N = 213) do not exhibit intentional modification, defined as modification that alters the normal contour of the cranial vault (Table 5.1, Figure 5.1).<sup>56</sup> Among modified individuals (N = 122), the majority exhibit oblique modification of the cranial vault (56%), followed by the erect (26%) and slight (14%) forms. Five individuals who could not be assigned to a specific modification category (4%) were juveniles whose cranial vaults are only partially conserved (completeness = 2 OR 3). Variation within these broad modification categories is further

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<sup>56</sup> Total sample (N = 213) for CVM analysis excludes 18 crania for which CVM presence is indeterminate due to fragmentary or incomplete preservation.

explored with respect to deforming technique, primary and secondary points of compression, and degree of deformation.

Table 5.1. Frequency of cranial vault modification, all samples pooled.

	Unmodified (%)	Modified (%)	Total
All samples	91 (42.7)	122 (57.3)	213

### *Classifying Variation in Head Shape*

In Chapter 4, I argued that the dichotomous approach to categorizing head shape (Tabular vs. Annular) homogenizes variation into ideal types, conflating modification technique with overall form. Crania in the Colca Valley do not conform strictly to this traditional dichotomy; with only a few exceptions, they are neither tabular because rigid boards are rarely used, nor annular since most crania are not laterally constricted, allowing for slight bilateral expansion, or at the very least, a posterior cranial vault that does not taper (cf. Antón 1989: Fig. 2). Because the crania under study exhibit characteristics “intermediate” to established categories, variation was further specified through the analysis of variables independent of overall form (see Appendix C). Thus, rather than define analytical categories a priori, I opt for a more exploratory approach by first examining variation within the general categories defined by the projection of the cranial vault (Unmodified/Unintentional, Erect, Oblique, and Slight), and then considering what biological, developmental, and social factors (e.g., age and sex) could account for this variation.

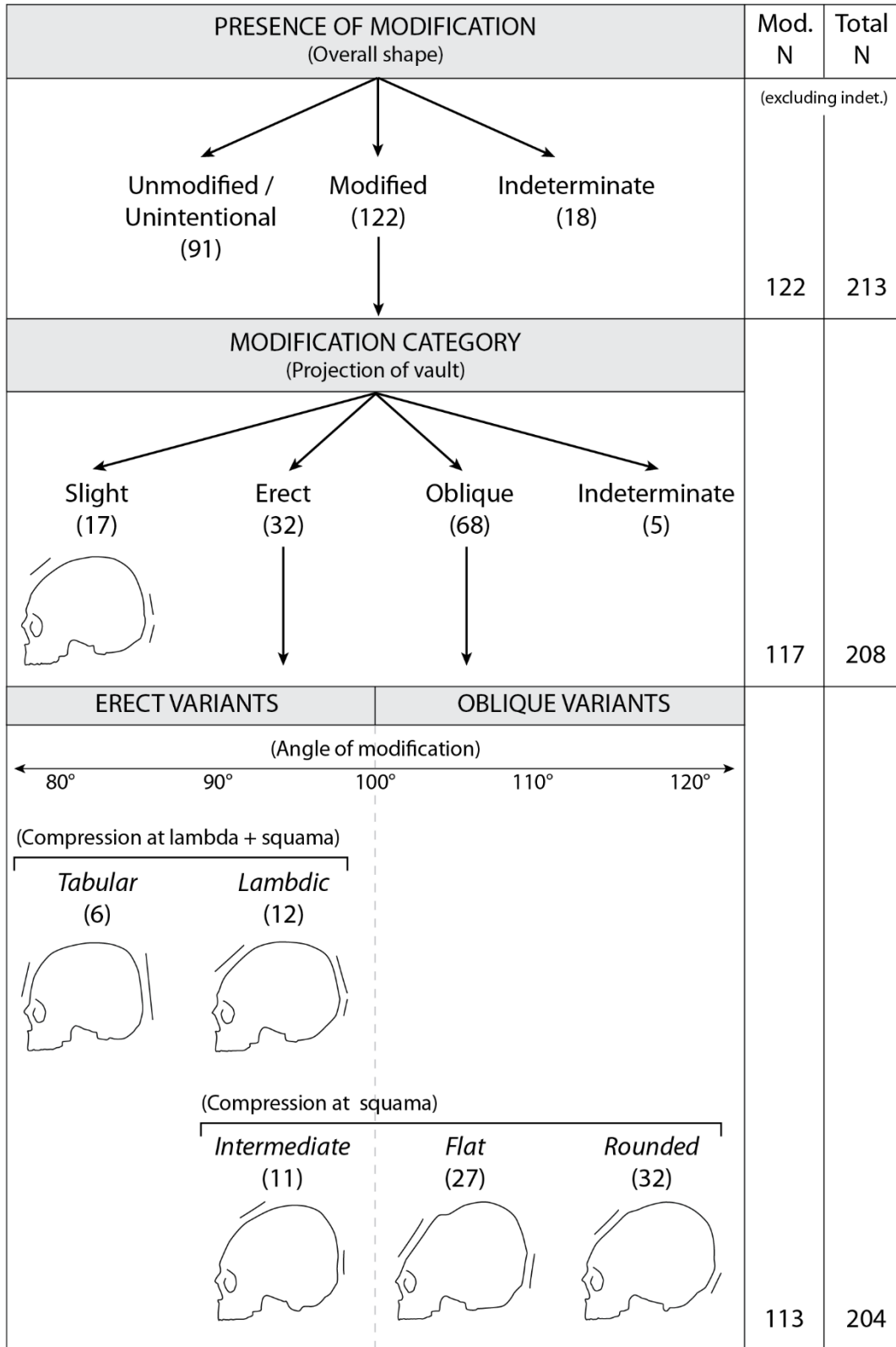


Figure 5.1. Schematic summary of modification categories and variants used in this study. Unique variants are included in total counts, but not illustrated.



Figure 5.1 presents a schematic of the classification system used in this study. Modified crania (N = 122) were first categorized based on overall shape and the projection of the cranial vault relative to the plane of the neck (Erect, Oblique, and Slight). Erect and oblique crania (N = 100) were further categorized into variants according to angle of modification, the center of posterior compression, and degree of occipital flattening. Of the 100 erect and oblique crania, 88 were classified into one of five variants: *Erect Tabular*, *Erect Lambdic*, *Erect Intermediate*, *Oblique Flat*, and *Oblique Rounded* (Figure 5.2). Because angle of modification is prioritized in the classification scheme, intermediate variants are grouped in the erect category in all tables, frequencies, and statistical results reported in text. However, these crania share characteristics with the oblique forms, such as extrinsic compression centered on the occipital squama (see below). In keeping with the exploratory approach of this study, the effect of this categorical distinction on overall interpretations is addressed in the discussion.

Four crania with incomplete preservation of the posterior vault could not be assigned to subcategory. Crania (N = 8) within the erect and oblique categories that exhibit characteristics falling outside of the typical range of any variant were classified as *Erect Unique* or *Oblique Unique* and excluded from statistical analyses based on subcategory. In all, posterior deformation was directly observable on 113 of 122 modified crania, and of these 113 crania, 105 were classified as slight or one of the five erect or oblique variants. Sample sizes used for statistical analysis vary depending on the level of categorization and the number of groups involved in the comparison. Each variant is described below and pictured in Figure 5.2. (Frequencies of each variant reported in-text are calculated using the N = 113 denominator.)



Figure 5.2. Erect and oblique variants defined and used in this study.

Within the oblique category, occipital shape and the center of compression on the squama are used to define two variants:

*Oblique Flat* is defined by the flattening of the occipital, centered on the superior portion of the occipital squama and usually extending to inion, if not actively directly tangential to it. Most crania in this category exhibit an intermediate angle of modification (100-115°), but in fact range from cases that are nearly erect to those exhibiting a more marked reclination of the cranial vault (>115°), which are reminiscent of Imbelloni's "tabular oblique" category (Dembo and Imbelloni 1938). However, in contrast to the prototypical form, oblique flat crania undoubtedly utilized pads, rather than rigid tablets and do not exhibit marked bilateral expansion, with only rare exceptions. In the lateral aspect, they are most akin to the "intermediate-mimetic" type defined by Romano (1965). In qualitative terms, the posterior-superior elongation of the cranial vault gives it an "egg-shaped" appearance (Figure 5.2). Twenty-four percent of modified crania (N = 113) were categorized as oblique flat.

*Oblique Rounded* crania similarly exhibit an intermediate angle (100-115°), the result of posterior compression centered on the superior squama. Unlike oblique flat, the posterior vault and occipital retain much of their natural curvature (Blom 1999).<sup>57</sup> The difference between the flat and rounded variants could possibly be a matter of degree, with the latter representing a slight-to-moderate expression of the oblique style, since both variants employed a similar modification technique involved pads and circular bindings.<sup>58</sup> Oblique rounded is the most common variant in the study sample, representing 28.3% of modified crania.

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<sup>57</sup> This is a qualitative distinction based on the "Occipital Shape" variable, see Appendix C. As Tiesler (2014: 39) notes, "unfortunately, there are no established specific measures in the literature" to metrically distinguish *occipitally curved* crania from other varieties.

<sup>58</sup> Specimens coded as either "Oblique-Rounded?" (N = 5) or "Oblique-Flat?" (N = 3), reflect the continuum of variation that exists between these variants of the oblique category. Excluding these specimens does not affect the results of chi-square tests of association between variants and demographic categories.

Within the erect category, three variants are defined based on differences in the center and extent of compression:

*Intermediate* crania most closely approximate the oblique forms in their center of compression (superior squama), but are differentiated by an angle of modification ( $<100^\circ$ ), giving the overall form a distinctly erect appearance. This slight difference in the plane of pressure may or may not be intentional. Based on the presence of supra-asterionic depressions as well as the restricted area of posterior compression, these crania were probably deformed through a “pseudocircular” modification technique that employed bandages in addition to pads, similar to the oblique forms (Tiesler 2014). Unlike other specimens in the erect category, those classified as intermediate do not exhibit plagiocephaly. In all, the intermediate subcategory is comprised of 11 specimens, representing 9.7% of the modified sample.

*Erect Lambdic* crania exhibit an unmistakable center of compression at lambda, along with compression of the superior squama. Slight-to-moderate posterior compression of these areas may be discontinuous (i.e., two distinct centers of compression) or continuous by way of longitudinally oriented impressions extending across the superior squama and lambda. Slight bilateral expansion of the parietals is common, but plagiocephaly is only observed in four of the 12 crania within this subcategory. The erect lambdic form was most likely produced from pad placement on the superior squama and posterior parietals, rather than the use of rigid tablets. All but three crania in this subcategory exhibit clear supra-asterionic depressions, suggesting the use of bindings. This variant accounts for 10.6% of modified crania.

*Erect Tabular* is most clearly differentiated from the oblique forms by the use of a large posterior pad or tablet extending across the occipital squama, lambda, and posterior parietals. Crania modified in the tabular style typically lack posterior-inferior parietal constriction and

exhibit a compressed basicranium (Figure 5.3). Only 5.3% of modified crania exhibit this type of deformation. The variety of tabular erect observed in the Colca Valley most closely approximates what has been called “plano-lámbdica” (Dembo and Imbelloni 1938: 272) or “plano-occipital” (Munizaga 1987: 126), or more colloquially, “cráneos achatados.” It is distinct from versions of tabular erect in which extreme antero-posterior compression results in a bilobate or conically-shaped cranial vault (e.g., Torres-Rouff 2003: Fig. 5.3).



Figure 5.3. Posterior, superior, and inferior aspects of tabular erect cranium from CO-118 (2000.0079).

*Unique* (N = 8) crania are characterized by an idiosyncratic shape or pattern of compression that does not fit within the characteristics of the five variants described above. Five crania were classified as “oblique unique” and three were classified as “erect unique.” These crania include especially severe cases of modification that have no match within the sample (Figure 5.4). For example, the pronounced circular modification of a female individual (1081.0924) more closely approximates the annular style from the altiplano region than the more moderate and less reclined pseudocircular forms typical of the Colca Valley (Figure 5.4-A).

Other specimens in this category exhibit multiple centers of compression and include markedly oblique crania with acute flattening at lambda. At least one of these unique individuals may have immigrated into the Colca Valley (1051.0015), as evidenced by a statistically outlying  $\delta^{13}\text{C}$  value (see Chapter 7: Figure 7.6). Because unique crania do not constitute a coherent category based on shared characteristics, they are excluded from statistical tests of association between subcategory and biological variables such as age and sex.

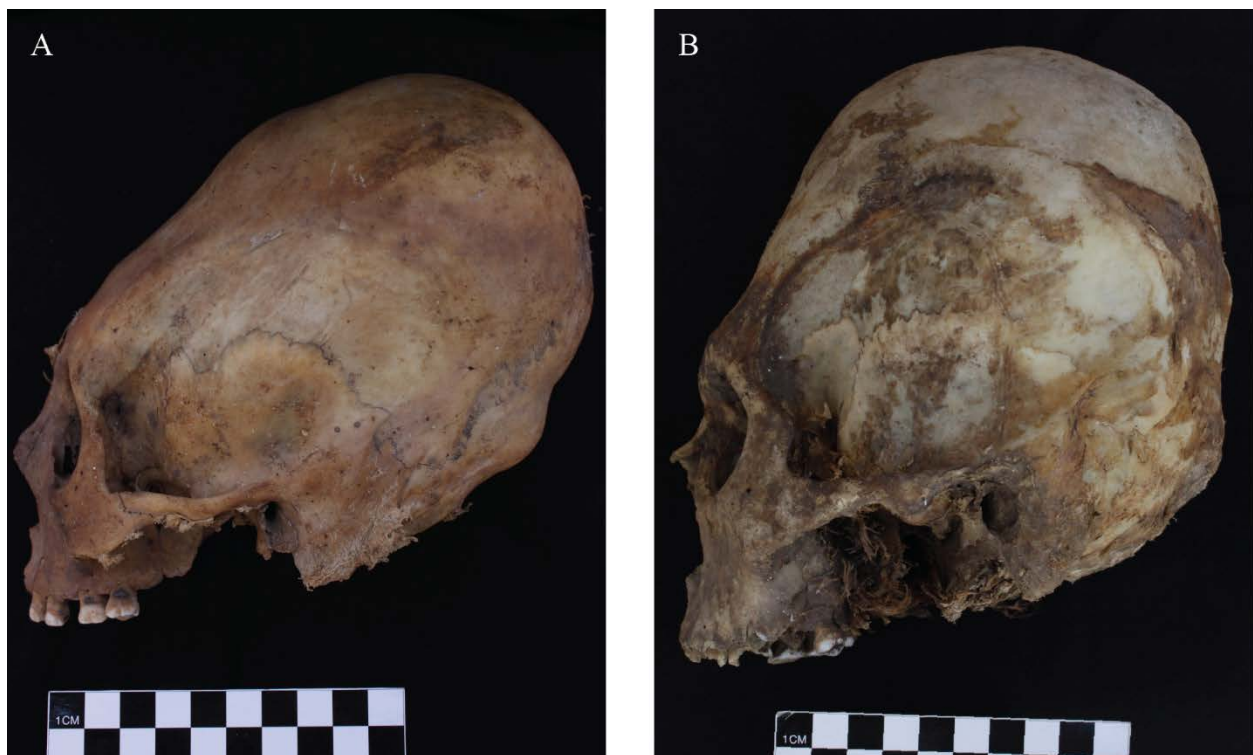


Figure 5.4. Unique forms of CVM documented in the Colca Valley: (A) Oblique unique (1081.0924); (B) Erect unique (2000.093).

#### *Variation in Secondary Points of Pressure*

In this study, secondary points of pressure are defined as irregular flattenings or depressions on the cranial vault that are the result of extrinsic pressure. They are “secondary”

because they fall outside of the primary centers of compression (frontal, occipital, and lambda) used to differentiate between variants. Secondary points of pressure were observed on all crania, regardless of modification status. Recall that the presence of modification is determined based on the overall shape of the cranium and whether or not it deviates from normal curvature. This criterion does not preclude the presence of slight flattenings or depressions on crania that are ostensibly unmodified in profile. Minor morphological changes on unmodified crania can potentially illuminate cultural antecedents or alternatives to cranial deformation. On visibly modified crania, the observation of secondary points of pressure can help clarify modification technique.

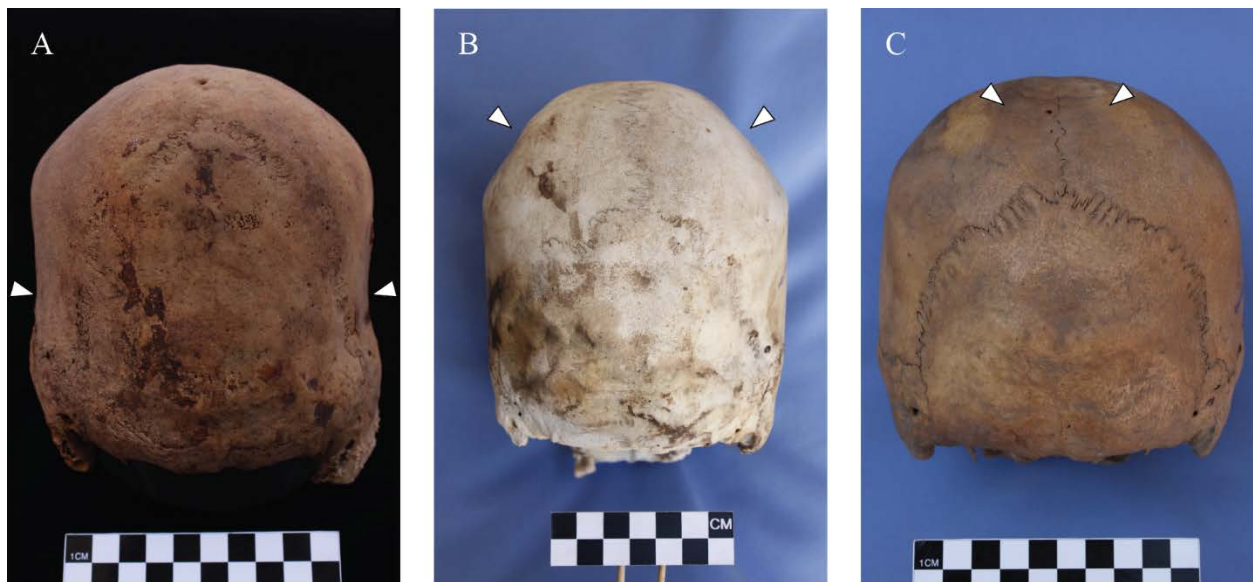


Figure 5.5. Secondary CVM variables recorded in this study: (A) supra-asterionic depression, (B) superior parietal impression, and (C) obelionic depression.

Table 5.2. Percentage of secondary points of pressure, by modification category and variant.

Modification Category	Supra-Asterionic		Superior Parietal		Obelionic	
	%	N	%	N	%	N
Erect						
Tabular	33.3	6	16.7	6	33.3	6
Lambdic	75.0	12	0.0	12	25.0	12
Intermediate	100.0	11	30.0	10	20.0	10
Unique	100.0	3	0.0	3	0.0	2
<i>Subtotal</i>	78.1	32	12.9	31	23.3	30
Oblique						
Flat	100.0	27	18.5	27	7.4	27
Rounded	90.3	31	6.5	31	10.0	30
Unique	100.0	5	0.0	5	25.0	4
<i>Subtotal</i>	95.2	63	11.1	63	9.8	61
Slight						
<i>Subtotal</i>	82.4	17	6.3	16	7.1	14
Total <sup>a</sup>						
All	57.7	196	7.0	200	13.8	189
Modified	87.6	113	10.6	113	13.2	106
Unmodified	16.9	83	2.3	87	14.5	83

<sup>a</sup> Total N includes modified crania for which category or subcategory was indeterminate.

Table 5.2 shows the percentage of crania that exhibit secondary points of pressure at or around asterion (“supra-asterionic depression”), euryon (“superior parietal impression”), and obelion (“obelionic depression”). Examples of each secondary characteristic are illustrated in Figure 5.5. Supra-asterionic depressions can be best observed in posterior view where the parietal bone thins at its posterior-inferior angle. Depressions in this region have been interpreted as evidence of bindings by Romano (1965). This study finds that the presence of a supra-asterionic depression is strongly correlated with the presence of modification ( $\phi = 0.707$ ,  $p < 0.001$ ). However, it cannot be determined whether they are evidence of direct pressure from constriction or an indirect effect of compression. Furthermore, unmodified crania with supra-asterionic depressions (16.9%,  $N = 83$ ) largely lack corresponding evidence of frontal



compression, suggesting that slight depressions in the supra-asterionic region are not completely outside of normal variation.

Superior parietal impressions usually occur bilaterally as slight or marked flattenings or depressions above euryon (Figure 5.5-B). They are relatively rare across the sample (6.9%, N = 204), but are also most clearly the result of superior straps or bandages tightly bound around the cranial vault. As such, they are more frequently observed on modified versus unmodified crania (10.6% vs. 2.3%; Fisher's, two-tailed,  $p = 0.025$ ). In particular, 10 of the 14 crania with superior parietal impressions are distributed between the intermediate and oblique variants, which also exhibit the highest frequencies of supra-asterionic depressions (90.3 % to 100.0%), previously associated with circular binding (Romano 1965; Table 5.2).<sup>59</sup> Among modified crania, secondary impressions superior to euryon may point toward a more widespread technique that functioned to limit bilateral expansion, but did not always leave clear impressions on the superior and lateral vault.

Unlike impressions superior to euryon and asterion, there is no association between modification presence and obelionic depressions (Fisher's exact, one-tailed,  $p = 0.484$ ). Pressure at obelion may variably manifest as a small circular (focal) depression, bilateral depressions parallel to obelion, or longitudinal flattening (extending from lambda). In no case do obelionic depressions approach the marked flattening typical of obelionic modification reported elsewhere (Nelson and Madimenos 2010). Obelionic flattening or depressions are evident on five crania in the oblique category. One such cranium exhibits a broad midline depression extending from lambda to obelion, giving the posterior vault a slightly bilobate shape (Figure 5.6). The same specimen also exhibits marked bilateral impressions superior to euryon. These morphological

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<sup>59</sup> The other four crania with superior parietal impressions are Unmodified (N = 2), Tabular Erect, and Slight.

changes suggest that modifying apparatus involving sagittal straps could have been used to produce oblique and elongated head shapes.

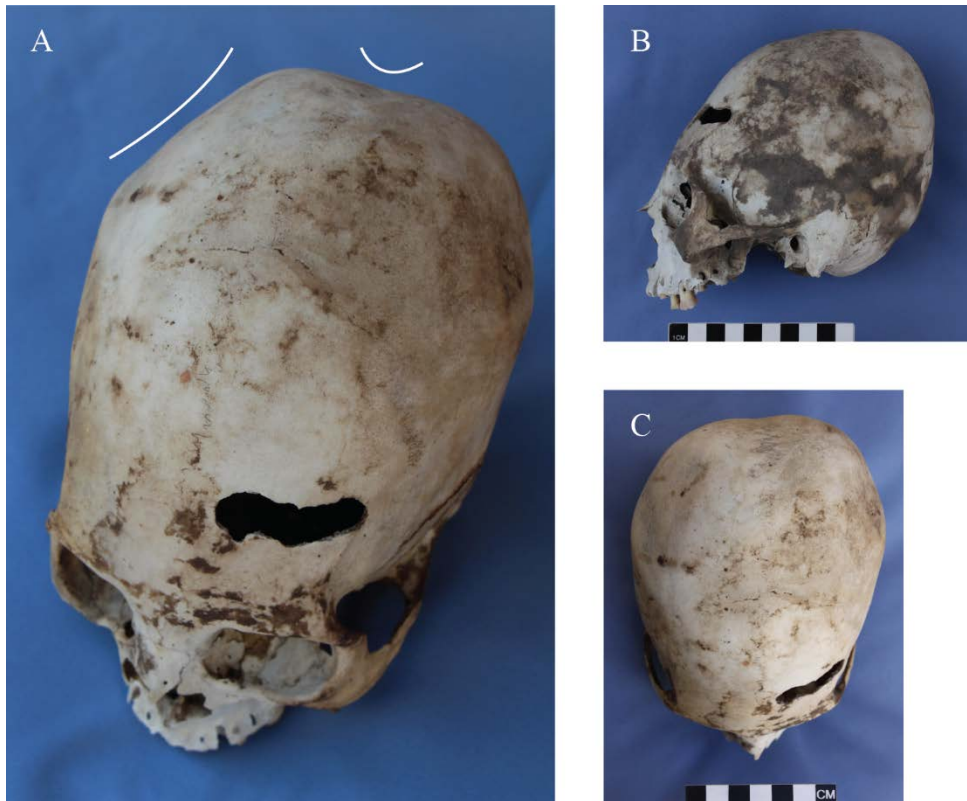


Figure 5.6. Cranium (1025.0104) with evidence of secondary pressure at obelion and on the superior parietal: (A) oblique view, (B) lateral view, and (C) superior view. Cranium is pictured in posterior view in Figure 5.5-B.

More enigmatic are unmodified crania that exhibit secondary points of pressure near euryon or obelion, despite an overall form that is normal. In all, two unmodified crania exhibit superior parietal impressions and 12 exhibit obelionic depressions (Table 5.2). Because these impressions are rare overall, lack uniformity in their appearance, and are not associated with a visible alternation in head shape, it is difficult to determine their etiology. They may represent abandoned or unsuccessful attempts to modify an infant's heads. It is more likely that

impressions on unmodified crania stem from hair bands, turbans, or other head gear that was not intended to change the shape of the head, but left slight markings on the ectocranium nonetheless. Following Tiesler (2014: 64), such impressions “may be indicative of day-to-day practices, but their morphological imprints on the neurocranium hardly communicate any choices by their practitioners that are directed to the head itself and its shape; their object is not the body.” Ultimately, crania with slight flattenings or depressions of ambiguous origin were grouped in the “Unmodified/Unintentional” category, since this study’s approach prioritizes overall shape. Nevertheless, these specimens represent a fruitful avenue for future research, which could be expressly designed to better characterize micro-morphological changes to cranial shape and cortical thickness that might result from habitual use of head gear or other adornments.

### *Age and Sex Differences*

Table 5.3 presents frequencies for each modification category sub-divided by general demographic category.<sup>60</sup> It is important to consider possible age and sex associations with modification presence and type prior to collapsing demographic categories in the diachronic and intra-cemetery analyses. Age and sex associations may also help explain if qualitative and quantitative variation in head shape, detailed above, derive from particular social practices (intentional) or represent biological or ontogenetic variation (non-intentional). Age associations, for example, can shed light on changes in overall cranial modification morphology over the life course, as the bones of the skull fuse in adolescence and compensatory mechanisms alter the intended form of the cranium following the period of compression. Sex associations, on the other

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<sup>60</sup> Because of small sample sizes, juvenile age categories “I” (N = 20) and “I/C” (N = 4) are collapsed into one, as are the “C” (N = 24), “C/T” (N = 7), and “T” (N = 9) categories. Only two cranial individuals were estimated as “F” or “F/I” (e.g., neonate), and neither was observable for CVM.

hand, would point toward the materialization of particular gender identities from a very early age through permanent body modification.

Are different modification categories “nothing more than reflections of the same deformation shape at different stages in human cranial growth and development” (Gerszten 1993: 90)? As in Gerszten et al.’s (1993) survey of over four hundred pre-Columbian crania from northern Chile, this hypothesis is not supported in the Colca Valley sample. There is no association between age category and the presence of modification ( $\chi^2 = 1.020$ ,  $df = 2$ ,  $p = 0.601$ ,  $N = 213$ ), nor between age category and modification category ( $\chi^2 = 9.855$ ,  $df = 6$ ,  $p = 0.131$ ,  $N = 208$ ) or subcategory ( $\chi^2 = 12.910$ ,  $df = 12$ ,  $p = 0.376$ ,  $N = 196$ ).

The relationship between degree of modification and age was also examined to explore if variation in the intensity of modification is partially age-regressive. We might expect advanced age and remodeling over the life course to alter cranial vault morphology, making it less severe over time (i.e., negative correlation between age and degree of modification). Indeed, it was common to observe infants with very pronounced modification; of the 12 infants (0-3 years) for whom degree of cranial modification was observable, 33.3% exhibit degree 3, or “prominent” modification and 16.7% exhibit degree 4, or “severe” modification (Figure 5.7). Despite these noteworthy cases, there is virtually no correlation between age category and degree of modification (Spearman’s  $\rho = -.004$ ,  $p = 0.482$ , 1-tailed,  $N = 119$ ).<sup>61</sup> In sum, age-related growth does not account for variation in cranial modification style in any regular way, and probably varied strongly at the inter-individual level.

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<sup>61</sup> Age category was recoded as an ordinal variable for nonparametric tests: (‘T’ → ‘1’) (‘I/C’ → ‘1’) (‘C’ → ‘2’) (‘C/T’ → ‘3’) (‘T’ → ‘3’) (‘T/YA’ → ‘4’) (‘YA’ → ‘4’) (‘YA/MA’ → ‘5’) (‘MA’ → ‘6’) (‘MA/OA’ → ‘7’) (‘OA’ → ‘8’). The result of non-correlation holds regardless of whether or not specimens are grouped in fewer age classes (as in Table 5.3), adults ( $N = 82$ ) and juveniles ( $N = 37$ ) are analyzed in isolation, or non-elongated forms (tabular erect, erect lambdic, and slight) are excluded from the sample ( $N = 84$ ).

Table 5.3. Frequency of modification categories, by demographic group.

	Modified <sup>a</sup>				Unmodified <sup>b</sup>		n	N
	Erect	Oblique	Slight	Indet.				
<b>Juveniles</b>								
I	3 (20.0)	7 (46.7)	1 (6.7)	4 (26.7)	15	9 (37.5)	24	
C/T	1 (4.0)	18 (72.0)	5 (20.0)	1 (4.0)	25	15 (37.5)	40	
<i>Subtotal</i>	4 (10.0)	25 (62.5)	6 (15.0)	5 (12.5)	40	24 (37.5)	64	
<b>Adults</b>								
F/F?	15 (31.9)	27 (57.4)	5 (10.6)	0 (0.0)	47	31 (39.7)	78	
M/M?	13 (43.3)	12 (40.0)	5 (16.7)	0 (0.0)	30	30 (50.0)	60	
?	0 (0.0)	4 (80.0)	1 (20.0)	0 (0.0)	5	6 (54.5)	11	
<i>Subtotal</i>	28 (34.1)	43 (52.4)	11 (13.4)	0 (0.0)	82	67 (45.0)	149	
<b>Total</b>	32 (26.2)	68 (55.7)	17 (13.9)	5 (4.1)	122	91 (42.7)	213	

<sup>a</sup> Percentage of modified total (n) in parentheses.

<sup>b</sup> Percentage of row total (N) in parentheses.

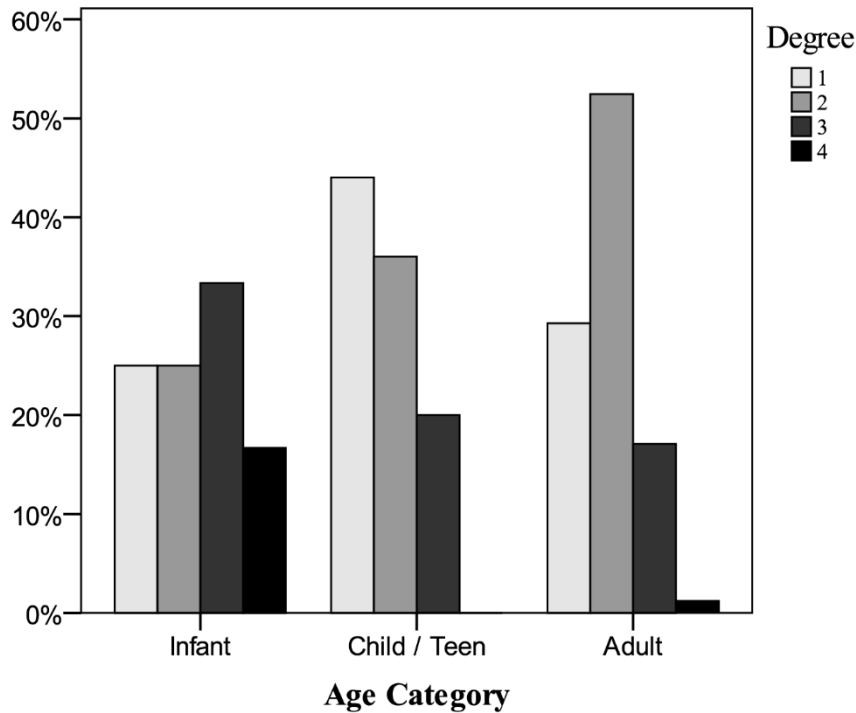


Figure 5.7. Frequency distribution of modified crania across age groups, by degree.

Likewise, no clear link between sex and modification presence or style was found, as in the majority of cranial modification studies in the Andes (Andrushko 2007; Blom 1999; Gerszten

1993; ; Torres-Rouff 2003: 179; but see Kurin 2012). Males and females were equally likely to have their heads modified as infants, both exhibiting CVM in moderate frequencies: 50% and 60.3% respectively (Fisher's exact, 2-tailed,  $p = 0.2996$ ). There is no apparent relationship between sex identification and overall projection of the vault (unmodified, erect, oblique, or slight) ( $\chi^2 = 3.643$ ,  $df = 3$ ,  $p = 0.303$ ,  $N = 138$ ), nor is there a significant relationship when specimens are grouped by subcategory ( $\chi^2 = 8.434$ ,  $df = 6$ ,  $p = 0.208$ ,  $N = 130$ ).<sup>62</sup> However, females are disproportionately represented within the oblique flat category, accounting for 82.4% ( $N = 16$ ) of crania exhibiting this modification variant (Table 5.4). Conversely, the sex distribution of individuals with the oblique rounded form is virtually even (8 males and 9 females). Although the sample of oblique crania for which both sex and subcategory could be assigned is rather small ( $N = 33$ ), the higher frequency of females within the oblique flat category (relative to the proportion of males and females within the oblique rounded category) is nearly significant at the 0.05 level (Fisher's, two-tailed,  $p = 0.057$ ).<sup>63</sup>

Was more pronounced occipital flattening a preferential choice for women with oblique modification? To the contrary, I consider it unlikely that oblique flat was intentionally ascribed to Collagua women as a means to achieve more elongated (*puntiagudo*) heads. First of all, females within the oblique category also exhibit rounded occipitals ( $N = 9$ ), which undermines the exclusivity of the more elongated form. Secondly, there is no evidence that the two variants employed different modification apparatuses, which we might expect if a clear difference in form were intended. Moreover, it is questionable if slight differences in occipital curvature would

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<sup>62</sup> Sex indeterminate crania and "unique" crania are excluded from statistical tests.

<sup>63</sup> Along similar lines, Torres-Rouff (2003: 86-87) finds that annular oblique forms are more common among females (85%,  $N = 60$ ) than males (69.5%,  $N = 59$ ) at the LIP site of Kupa Pukio Chullpa ( $\chi^2 = 4.079$ ,  $p \leq 0.043$ ,  $N = 119$ ).

even have been discernible on the fleshed skull, covered by hair and possibly adorned with headdresses.

Larger sample sizes from other mortuary sites in the Colca Valley may help clarify this suggestive pattern. At present, the most likely explanation is that the difference between male and female oblique modification is simply matter of degree and not a qualitative social distinction. Oblique flat crania, on average, exhibit a lower modification ratio (i.e., greater elongation) compared to oblique rounded crania: 0.955 and 1.046, respectively.

Correspondingly, the average modification ratio of modified females (1.0027) is lower than that of modified males (1.0587), and the difference of means is statistically significant (Independent Samples t-test,  $t = 3.641$ ,  $df = 66$ ,  $Sig. = 0.001$ ).<sup>64</sup> Although cranial modification must occur during the first few years of life when the vault bones are malleable, physiological compensatory forces continue to act upon the cranium into adulthood after the period of cultural compression (Tiesler 2014). Thus, while more severely modified female heads may relate to different child rearing practices, they more likely reflect physiological differences in the compensatory response to artificial compression, whereby the tensile force of the nuchal muscles counteracts postero-superior expansion to a greater extent in physically robust males, conserving a more normal occipital curvature.

At the same time, sex differences in modification degree may actually reflect bias in the sex estimation of modified crania themselves (see Chapter 4). That is, more intense modification may moderate the expression of sexually dimorphic cranial features, such that “gracile” male crania are misidentified as “female” or “possible female” (Pomeroy, et al. 2010: 323). This

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<sup>64</sup> “Pronounced” cases of modification also constitute a higher proportion of modified female crania (23.4% vs. 10.0%,  $\chi^2 = 3.145$ ,  $N = 77$ ,  $df = 3$ ,  $p = 0.370$ ). Andrushko (2007: 200, fn. 6) also finds that a greater proportion of females exhibit “pronounced” modification, although it is likewise not statistically significant.

possibility raises an issue of equifinality that cannot be resolved with the current data set. Either way, the difference between males and females with respect to occipital curvature should be interpreted with extreme caution, especially since the preponderance of evidence suggests that no one style was rigorously gender normative.

Table 5.4. Sex distribution by modification category, adult sub-sample (N = 81).

Modification Category	Sex <sup>a</sup>						N
	F/F?		M/M?		Indet.		
<b>Erect</b>							
Tabular	2	(40.0)	3	(60.0)	0	(0.0)	5
Lambdic	6	(50.0)	6	(60.0)	0	(0.0)	12
Intermediate	6	(66.7)	3	(33.3)	0	(0.0)	9
Unique	1	(50.0)	1	(50.0)	0	(0.0)	2
<i>Subtotal</i>	15	(53.6)	13	(46.4)	0	(0.0)	28
<b>Oblique</b>							
Flat	14	(82.4)	2	(11.8)	1	(5.9)	17
Rounded	9	(45.0)	8	(40.0)	3	(15.0)	20
Unique	3	(60.0)	2	(40.0)	0	(0.0)	5
<i>Subtotal</i>	26	(61.9)	12	(28.6)	4	(9.5)	42
<b>Slight</b>							
<i>Subtotal</i>	5	(45.5)	5	(45.5)	1	(9.1)	11
<b>Total</b>	46	(56.8)	30	(37.0)	5	(6.2)	81

<sup>a</sup> Percentage of row total (N) in parentheses.

In sum, because of the lack of sex differences and the fact that variation in modification type or severity was not age-specific, demographic groups will be collapsed for subsequent analysis of spatial and temporal variation in CVM prevalence and style. Variation between and within modification subcategories, in large part, may stem from idiosyncratic factors such as the duration of compression, practitioner skill, biomechanical properties of the cranium, compensatory growth, or a combination thereof. The only subcategory that represents a qualitatively different modification technique is the tabular erect variant, so it will be separated



from other erect varieties in subsequent analyses. The status of intermediate crania relative to other forms remains ambiguous, although there is suggestive evidence that oblique and intermediate crania resulted from the same modification technique. Ultimately, I defer to overall form/category, rather than modification technique in subsequent analyses, but will verify that retaining this analytical designation does not significantly alter overall interpretations.

Table 5.5. Frequency of cranial vault modification, by time period.

	Unmodified (%)	Modified (%)	Total
Early LIP	59 (60.8)	38 (39.2)	97
Late LIP	30 (26.3)	84 (73.7)	114

### *Temporal Differences*

Diachronic studies of cranial modification have the potential to elucidate processes of ethnic diversification, social transformation, and political centralization over the *longue durée*, and the role that the body plays in mediating these cultural changes (Andrushko 2007; Torres-Rouff 2003). To investigate how cranial modification practices changed over time, the Colca Valley cranial sample was partitioned temporally into “Early LIP” (A.D. 1150-1300) and “Late LIP” (A.D. 1300-1450) based on associated radiocarbon dates and architectural evidence. Comparing these two time periods, one observes that the overall proportion of modified to unmodified individuals practically reverses across time (Table 5.5). Cranial modification prevalence increases from 39.2% (N = 97) in the early period to 73.7% (N = 114) in the later period, a highly statistically significant difference (Fisher’s exact, two-tailed,  $p < 0.0001$ , N = 211). A dramatic shift in the overall frequency of oblique modification drives this result, jumping from 14.4% to 47.4% between time periods (Table 5.6).

Differences between time periods in the relative frequencies of modification types are highly statistically significant ( $\chi^2 = 40.299$ ,  $df = 4$ ,  $p < 0.0001$ ,  $N = 206$ ), even when unmodified crania are excluded from cross-tabulation ( $\chi^2 = 18.281$ ,  $df = 3$ ,  $p < 0.001$ ,  $N = 117$ ). In the Early LIP, individuals with modification ( $N = 38$ ) are roughly equally distributed among the four key categories: Erect (28.9%), Erect-Tabular (15.8%), Oblique (36.8%), and Slight (15.8%) (Figure 5.8). In the Late LIP however, 64.3% of all modified individuals ( $N = 84$ ) exhibit an oblique or slightly oblique cranial vault (angle  $> 100$ ). The increase in oblique modification—the stereotypical “Collagua” modification—occurs across all demographic categories and both modification variants (oblique flat and oblique rounded), as expected.<sup>65</sup> Conversely, erect forms become less common (17.9%), whereas they had constituted nearly half of all modified crania in the early period (44.7%,  $N = 38$ ). In fact, the tabular erect style is not observed in late-period contexts at all. Finally, the frequency of crania with slight modification remains relatively consistent between time periods, (15.8% vs 13.1% of modified crania).

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<sup>65</sup> Frequency of intermediate forms also increase across time, an additional line of evidence that they are technically associated with the oblique modification.

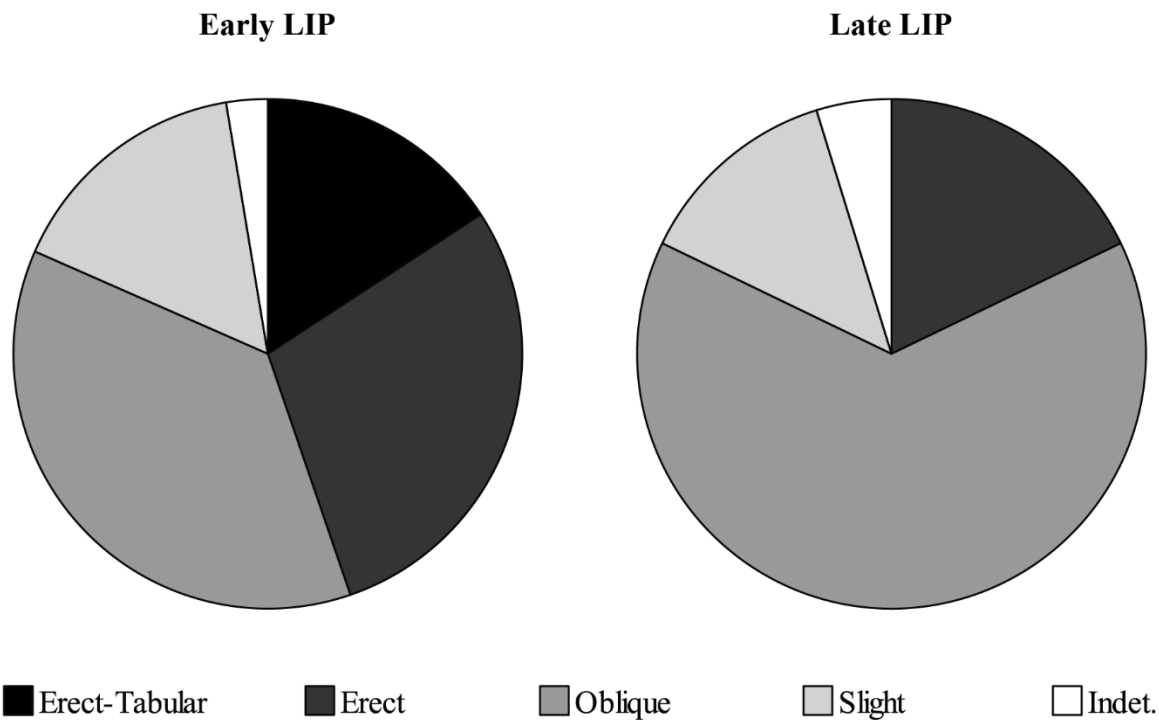


Figure 5.8. Distribution of cranial vault modification types, by time period.

Table 5.6. Frequency of cranial vault modification, by time period and mortuary context.

Chamber	Modified										Unmodified		N	
	Erect (Tabular)		Erect		Oblique		Slight		Indet.					
Early LIP														
Sahuara		6	(7.9)	10	(13.2)	13	(17.1)	5	(6.6)	1	(1.3)	41	(53.9)	76
Yuraq Qaqa	028	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	5	(100.0)	5
Yuraq Qaqa	051	0	(0.0)	0	(0.0)	0	(0.0)	1	(16.7)	0	(0.0)	5	(83.3)	6
Yuraq Qaqa	054	0	(0.0)	1	(10.0)	1	(10.0)	0	(0.0)	0	(0.0)	8	(80.0)	10
<i>Subtotal</i>		6	(6.2)	11	(11.3)	14	(14.4)	6	(6.2)	1	(1.0)	59	(60.8)	97
Late LIP														
Yuraq Qaqa	003	0	(0.0)	5	(17.9)	9	(32.1)	1	(3.6)	0	(0.0)	13	(46.4)	28
Yuraq Qaqa	027	0	(0.0)	0	(0.0)	7	(53.8)	3	(23.1)	0	(0.0)	3	(23.1)	13
Yuraq Qaqa	035	0	(0.0)	10	(13.7)	38	(52.1)	7	(9.6)	4	(5.5)	14	(19.2)	73
<i>Subtotal</i>		0	(0.0)	15	(13.2)	54	(47.4)	11	(9.6)	4	(3.5)	30	(26.3)	114
<b>Total</b>		6	(2.8)	26	(12.3)	68	(32.2)	17	(8.3)	5	(2.4)	89	(42.2)	211

Percentage of row total (N) in parentheses. Indeterminate crania excluded from chi-square tests.

Table 5.7. Modification ratio, by chamber and site.

Site	Chamber	All crania			Modified crania			“Elongated” crania		
		Mean	s.d.	N	Mean	s.d.	n	Mean	s.d.	n
Yuraq Qaqa	003	1.095	.085	22	1.031	.051	12	1.021	.052	8
Yuraq Qaqa	027	1.056	.123	12	1.000	.074	9	0.978	.066	7
Yuraq Qaqa	035	1.047	.097	60	1.010	.067	46	1.003	.071	38
Total										
Sahuara		1.126	.102	70	1.049	.088	32	1.014	.095	16
Yuraq Qaqa		1.080	.106	113	1.014	.066	70	1.002	.067	54

Elongated subsample includes oblique, erect intermediate, and unique variants. Chambers with < 3 modified crania excluded from tabulation.

Table 5.8. Frequency of cranial vault modification, by site.

	Unmodified (%)	Modified (%)	Total
Sahuara (CO-118)	41 (53.9)	35 (46.1)	76
Yuraq Qaqa (CO-098)	50 (36.5)	87 (63.5)	137

*Inter- and Intra-Site Differences*

A closer look at cranial modification patterns between and within sites reinforces these temporal differences. At Sahuara (CO-118), the smaller mortuary site that lacks the elaborate sepulchers, the majority of the Early LIP sample (75 of 96 individuals) is found here; 53.9% of those Sahuara crania are unmodified (N = 76) (Table 5.8). All modification categories are present at Sahuara, albeit in low overall frequencies (<20%) (Table 5.6). Erect crania constitute a greater proportion of modified crania (45.7%, N = 35), relative to oblique crania (37.1%). Notably, the only six tabular erect crania reported in this chapter (5 adults, 1 juvenile) were recovered here.

At Yuraq Qaqa, 80-100% of crania from contexts associated with early dates (CO-098-028, CO-098-051, CO-098-054) are unmodified (Table 5.6, Figure 5.9). In the cases of CO-09-028 and CO-098-051—“primal” chambers built during the earliest phases of construction at their respective sectors (12<sup>th</sup> and 13<sup>th</sup> centuries, respectively)—modified crania are virtually absent; the sole exception is a child (5-8 years) with slight modification from Chamber 51. Although the sample of Early LIP crania from excavated contexts at Yuraq Qaqa is small (N = 21), the near absence of modified crania is highly statistically significant, compared to the ratio of modified-to-unmodified crania in chambers with later dates (Fisher’s exact, 2-tailed,  $p < 0.0001$ ).

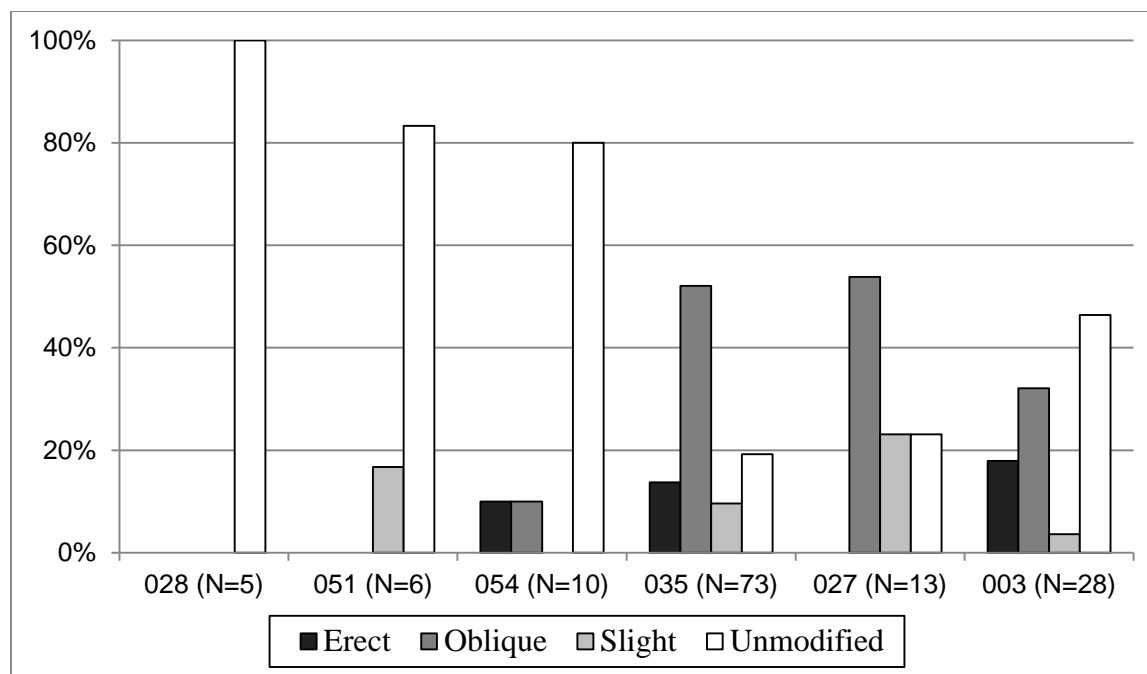


Figure 5.9. Frequency of modification type by mortuary context at Yuraq Qaqa. X-axis ordered chronologically; 035, 027, and 003 are Late LIP. Modified crania of indeterminate category are excluded from graph.

The Late LIP sample reported in the previous section is comprised of three contexts at Yuraq Qaqa dating after A.D. 1300. CO-098-035 and CO-098-027 show statistically similar CVM distributions ( $\chi^2 = 3.428$ ,  $df = 3$ ,  $p = 0.330$ ,  $N = 82$ ), although the small sample size of the latter chamber ( $N = 13$ ) limits statistical power. Nonetheless, oblique crania constitute 55.1% and 54.8% of their respective samples, and unmodified crania are also present in moderate frequencies (~20%) in these two later structures (Table 5.6, Figure 5.9). Unlike Chamber 027, Chamber 035 contains ten crania categorized as erect, although six of these are of the intermediate variety.

CO-098-003 stands apart from the other two late-period contexts. Here unmodified crania outnumber any single modification category. The difference in distribution is statistically significant at the 0.05 level (003 vs. 027,035:  $\chi^2 = 3.428$ ,  $df = 3$ ,  $p = 0.026$ ,  $N = 110$ ). In contrast

with the early-period samples, however, modified individuals, as a whole, constitute the majority (53.6%, N = 28) of the burial cohort. Oblique forms remain the most prevalent (32.1%), followed by erect forms (18%) of both the intermediate and lambdaic variety. A single individual was categorized as slight (4%).

Modification ratios provide an additional line of evidence on CVM variation within and between sites (Table 5.7). Here I discuss only modification ratios of *modified* crania, since variation in the ratios of the entire sample is largely driven by the proportion of unmodified crania within each context. Greater heterogeneity in *modified* head shape at Sahuara, the only context where all modification variants are present, is underscored by a higher standard deviation of the modification ratio (.088), compared to Yuraq Qaqa (.066) (Table 5.7). Modification ratios and standard deviation values are also more similar between Chambers 027 and Chambers 035, than they are between either of those chambers and Chamber 003. This is likely due to the fact that “pronounced” cases of modification (Degree  $\geq 3$ ) are absent at Chamber 003, whereas their inclusion in combined sample from Chambers 027 and 035 increases variability (s.d.) while driving down the average modification ratio. However, the difference in average modification ratio is not statistically significant (003 vs. 027/035:  $t = -1.157$ ,  $df = 65$ ,  $p = 0.251$ ).

Finally, the distribution of the secondary points of pressure, discussed at the outset of the chapter, is not patterned on burial location in any meaningful sense. Supra-asterionic depressions are more frequently observed in late-period chambers, but only because this characteristic is nearly isomorphic with the oblique forms, which increase over time. Modified crania that exhibit pressure at or around euryon and obelion are relatively rare (7.9% and 13.8%, respectively, see Table 5.2), and so it is difficult to draw firm conclusions regarding their inter-site or intra-site distribution, other than to say that secondary characteristics are not localized to any one chamber.

Nevertheless, it is worth noting that 10 of the 14 cases of superior parietal impressions are found on elongated, or “pseudocircular,” crania from the late-period contexts at Yuraq Qaqa. None of the elongated crania (N = 16) at Sahuara exhibit this feature—only one tabular erect and two unmodified crania. Finally, unmodified crania with ambiguous evidence of compression are distributed evenly across Sahuara (N = 10) and Yuraq Qaqa (N = 14), relative to the total frequency of unmodified crania at each site (Table 5.8).<sup>66</sup>

In sum, the cranial sample from the Colca Valley demonstrates that 1) modification rates, especially of the oblique form, increase over time; 2) modification variants, with the exception of tabular erect, are not exclusive to any mortuary context; and 3) unmodified individuals are present at both sites and in each tomb context at both sites.

## Discussion

### *Standardization across Time*

In cranial modification studies, the term “standardization” has been used to denote either homogeneity of style across a population (i.e., percent exhibiting a predominant type, see Torres-Rouff 2003) or the consistency with which techniques were applied to the cranium (i.e., correspondence of shape, see Kuzminsky and Tung 2016). The bioarchaeological data presented in this chapter reveal the cranial modification practices in the Colca Valley were neither universally adopted nor uniformly implemented. At least two qualitatively distinct modification *techniques* were used in the upper Colca Valley during the LIP: fronto-occipital compression of the “tabular” variety (erect tabular) and “pseudocircular” binding (oblique, intermediate), the

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<sup>66</sup> Ambiguous cases were designated by one or more of the following criteria: a) an overall shape borderline between slight and unmodified (e.g., “unmodified?” see Figure 4.8), b) slight fronto-occipital compression that did not visibly alter head shape, and/or c) pressure at/around obelion or euryon.



former characterized by expansive pads or boards across the posterior crania (occipital, lambda, and posterior parietals), and the latter by a more restricted area of occipital compression combined with circular binding.<sup>67</sup>

Among the pseudocircular crania defined by similar pad and band impressions (oblique flat, oblique rounded, and erect intermediate), head shape appears quite distinct in profile, varying with respect to the degree of elongation and posterior reclination (Figure 5.2). Heterogeneity in modification degree within and across all age groups (Figure 5.7) suggests that the duration and intensity of binding techniques were not standardized, resulting in remarkable inter-individual variation in the ultimate shape of the cranium subsequent to childhood growth. Physiological compensatory mechanisms following the period of extrinsic compression might also account for some variation in adult head shape, and specifically for sex differences in modification degree and occipital curvature. In sum, the available data suggest that micro-variations in angle, elongation, or occipital shape do not signal meaningful social differences (e.g., gender or burial group), nor do they reflect age-related changes, supporting Gerszten et al.'s (1993: 91) finding that such variations are likely the result of “no more than minor arbitrary differences in the angle at which a board was applied to the infant’s head, or a combination of factors such as nutritional status, genetics and overall health of the individual.” If so, caretakers or practitioners may have aspired to a shared aesthetic of elongating the skull in order to mimic their mythological origin place, but with varying success, as may be the case for crania that are only slightly modified. Whether or not the resulting occipital plane was oblique or erect, curved

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<sup>67</sup> The categorical status of erect lambdic forms with respect to modification technique is more ambiguous since these crania exhibit unmistakable lambdic flattening (the result of occipital pads placed more superiorly on the posterior vault), but also supra-asterionic depressions in 75% of cases (N = 12), a possible indicator of circumferential binding.

or flat, may have been outside of intention—and ultimately a distinction only made by physical anthropologists.

Despite inconsistencies in modification technique and outcome, the increase over time in prevalence of CVM in general, and oblique modification in particular, signals a move toward greater homogeneity of style during the Late LIP. Torres-Rouff (2003) shows how the modification rates roughly correlate with level of social complexity across a large, multi-regional sample. Smaller-scale societies inconsistently adopt modification practices, whereas complex societies exhibit higher rates of CVM, indicative of relative standardization at the societal level. The Early LIP sample more closely resembles the pattern for small-scale societies, in which a substantial portion of the population is unmodified, and no one modification type or variant predominates (Torres-Rouff 2003; see Figure 5.8). In the Late LIP, however, more individuals are being modified during childhood, and oblique forms account for an overwhelming majority of them (64%, 54/84 modified crania). If intermediate crania are grouped with oblique crania, this pattern becomes more pronounced, with pseudocircular forms accounting for 73.8% of all modified crania during the Late LIP (N = 84), compared to 44.7% during the Early LIP (N = 38).

This dual increase in the frequency of modification overall and oblique modification in particular is validated even at the scale of adjacent chambers (027 & 028), where we see a clear adoption of modification practices over time: all four crania from the lower chamber (028), one of the earliest tombs constructed at Yuraq Qaqa, are unmodified, while 10 of 13 crania in Chamber 027 are modified and include one of the most pronounced cases of artificial elongation in the entire sample. The absence of tabular forms from late-period contexts is also consistent with the movement toward homogeneity. Taken as a whole, the reduction of diversity in CVM type during the Late LIP, in favor of a normative style, suggests that the way individuals buried

in elite cemeteries viewed themselves and others, and how they embodied these social differences, changed dramatically over time. In Chapter 8, I interpret this changing standard with regard to how corporal identity was performed as a kind of ethnogenesis, involving the emergence of new forms of marking “group distinctiveness” (*sensu* Sturtevant 1971)—if not necessarily the creation of a wholly new ethnic group, considering that defining characteristics of the Collagua ethnicity (e.g., pastoralist lifeways) were almost certainly in place by the Early LIP.

Moreover, unlike traditional models of ethnogenesis in which ethnic identity subsumes multiple families, clans, or lineages (Emberling 1997), Collagua identity was not marked on the bodies of all members of society. That is, the absence of modification continues to characterize a moderate proportion of the Colca Valley burial population. Individuals that do not exhibit visible alteration of the head represent over a quarter of those recovered from Late LIP mortuary contexts (26.3%, N = 144). Modification rates reported in this study are also significantly lower than those for altiplano or altiplano-affiliated sites during the same time period, such as Kupa Pukio Chullpa in Bolivia (99.2%, N = 131) or Caspana in the Loa River Valley (98.3%, N = 58) (Torres-Rouff 2003). Indeed, four of seven sites in Torres-Rouff’s (2003: 98) “complex society” sample exhibit modification frequencies over 90%, cautioning against an overemphasis on standardization of head shape in the LIP Colca Valley.

The persistence of unmodified individuals at moderate rates throughout time also calls into question the notion that head shape was utilized as an indicator of regional ethnic identity, as implied by ethnohistoric accounts (Ulloa Mogollon 1965 [1586]). Certainly, if CVM rates continued to increase during the Late Horizon and Early Colonial period, it is possible that Ulloa’s characterization of elongated head shape as emblematic of the Collagua people of the

central Colca Valley was well founded. However, during the LIP, cranial modification does not appear to have been strongly regulated or enforced upon all segments of society.

Even so, temporal trends in cranial modification data from the Colca Valley support broader patterns across the central and southern Andes that illustrate the important role cranial modification played in the consolidation and differentiation of group identities across the Late Intermediate Period and into the period of Inka rule. In San Pedro de Atacama, Torres-Rouff (2003: 123, 142-143) found a steady increase in modification frequency over time, particularly of the tabular erect style following the Middle Horizon, which she interprets as a resurgence of local tradition in the context of inter-valley competition over resources following Tiwanaku collapse. Gerszten and colleagues (1993: 92) also observe a shift from annular to tabular erect modification in the Azapa Valley, but it occurs later in time with the onset of the Inka conquest, and only represents a change in custom rather than prevalence, since modification rates remained high throughout prehistory there. In Andahuaylas, CVM rates skyrocket from 0% in the Middle Horizon sample (N = 36) to 76% during the LIP (N = 273), as local populations reconfigured social, economic, and political networks in the wake of Wari collapse (Kurin 2016b).

Andrushko's (2007) study of temporal changes in CVM prevalence and style in the Cuzco valley shows nuanced differences from these dominant trends, but ultimately reflects a political landscape in which head shape increasingly anchored in-group and out-group boundaries, either in anticipation of—or as a direct response to—Inka imperial policies. Unlike the trajectory in the Colca Valley and elsewhere, the rate of unmodified crania actually increases over time, particularly at core sites within the Inka Empire (Andrushko 2007: 200). At the same time, the annular oblique style becomes more common among modified crania, increasing from

29.2% (7/24 modified crania) during the Pre-Inka<sup>68</sup> era to 79.2% (61/77 modified crania) during the Early Inka and Late Horizon periods (A.D. 1290-1532), which Andrushko (2007) interprets as the result of migration into the imperial heartland. This shift is especially pronounced in the periphery where the annular style is “eight times more likely to appear” (Andrushko 2007: 201). In sum, CVM heterogeneity in the periphery served to differentiate foreign enclaves, whereas its relative absence in the core distinguished the Inka elite from their subject populations.

Despite slight differences in the timing, character, and magnitude of stylistic change, these regional studies highlight the various endogenous and exogenous factors that can synergistically contribute to the formation of “group distinctiveness,” including local tradition, adoption of outside customs, inter-group competition, the centralization of political control, and subjugation by a foreign power. Several of these factors contributed to the social and political atmosphere in the Colca Valley under which cranial modification gained prominence during the Late LIP. Archaeological evidence from the Colca Valley reveals increasing evidence of status differentiation during the LIP in the form of domestic architecture, household size, and site layout, as well as the emergence of above-ground funerary construction, which was probably elite in nature (Wernke 2013). New forms of body modification may have reinforced nascent social differentiation in the political and economic spheres, consistent with the positive correlation of social complexity and increasing standardization in cranial modification practices documented by Torres-Rouff (2003).

Importantly, autochthonous social differences in the Colca Valley were later co-opted and partly restructured by Inka policies of social organization, suggesting that modification practices

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<sup>68</sup> In Andrushko’s study, Pre-Inka includes EIP, MH, and LIP samples, which were collapsed for all statistical analyses due to small sample size; however, all Pre-Inka annular crania come from LIP contexts, and so the percentage of annular among modified crania during the early LIP is possibly higher than reported.

were not purely endemic to Colca Valley but conditioned by foreign politics, indirectly or otherwise. Situated on the periphery of Inka influence, the shift toward stylistic homogeneity and pseudocircular cranial modification in the Colca Valley is not unlike the pattern documented by Andrushko (2007) outside of the imperial core. Unlike the Cuzco periphery, however, the emergence of a dominant style in the Colca Valley does not appear to be the result of large scale in-migration (see Chapter 8). Moreover, the timing of changes in CVM prevalence precede the traditional onset of Inka imperialism, suggesting that the practice of head binding was not simply imposed upon the inhabitants of the Colca Valley by foreign conquerors, but rather negotiated through local lineage politics situated within broader economic and social networks of prestige that were increasingly (but not exclusively) dominated by the nascent Inka state. The relationship between Collagua ethnogenesis, as suggested by the increasing frequency of oblique modification form, and the expansion of an Inka sphere of influence into the Colca Valley will be taken up in Chapter 8.

#### *Corporate Group vs. Inter-Group Alliance Hypotheses*

Major changes in CVM rates at the population level must also be considered in light of their distribution across different segments of society: Did the adoption of modification practices serve to reinforce group divisions at the local or regional level, or rather, did they provide a highly conspicuous and enduring point of articulation between them? Although the skeletal sample is likely not representative of a entire population (see Velasco 2014), exploring how the social identit(ies) indexed by modification practices map onto mortuary space can serve as a proxy for community dynamics. Recall the two primary models of mortuary behavior and inter-group interaction laid out in Chapter 2: corporate group differentiation vs. inter-group alliance.

The first hypothesis predicts that particular lineages will reinforce their autonomy and resource rights through shared, but exclusive, symbols of group membership. In this model, strong within-group identity is symbolized in part by shared norms of head binding, resulting in the correspondence of particular modification styles with burial location (Hoshow, et al. 1995). Alternatively, the inter-group alliance hypothesis positions mortuary practice as a vehicle for social alliance. Individuals with different head shapes—and by extension, diverse social or ethnic identities—will be buried together as a strategy to reinforce cooperation among the living and buffer against external threats or environmental challenges.

Prima facie, cranial modification data from the Colca Valley do not support the corporate group hypothesis. Individuals with distinct head shapes, modified and unmodified, were buried together in the same above-ground mortuary structures. Only at Chamber 028, where all five individuals are unmodified, could head shape be characterized as homogenous. In addition, slight variations in form, such as angle of modification and center of posterior compression—if indeed they were intentional—do not map onto mortuary boundaries. Given the chronological evidence for the relative contemporaneity of burial structures and skeletal remains presented in Appendix A, it is unlikely that unmodified individuals are simply earlier occupants displaced by later additions to the burial cohort.<sup>69</sup> Even if this were so, the decision to assimilate morphologically and socially distinct individuals into the same burial structures across time would represent a sort of “meta-historical” social integration, emphasizing the shared affinity between individuals, rather than their social or historical differences. Either way, the social norms that governed burial group membership in the Colca Valley were clearly distinct from those that shaped whether or not a child’s head was modified at birth.

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<sup>69</sup> Kurin (2012) also presents evidence that modified and unmodified individuals from Andahuaylas were likely buried contemporaneously in the same mortuary contexts.



Figure 5.10. Tabular erect crania from (A) Sahuara and (B) Kallimarka, located in Cabanaconde.

Cranial modification diversity is most accentuated at the cemetery of Sahuara, where individuals with markedly different modification techniques (pseudocircular and tabular) were buried within the same burial cave. Scholars in the Andes have traditionally interpreted intra-cemetery or intra-site heterogeneity in cranial vault modification as “multi-ethnicity” (Blom 1999: 164; Goldstein 2015; Pechenkina and Delgado 2006). In fact, crania modified in the tabular erect style, which are found exclusively at Sahuara, are morphologically similar to modified crania from elite burial sites near the modern village of Cabanaconde in the lower valley, the heartland of the Cabanas ethnic group (Figure 5.10). The co-interment of individuals with different cranial modification styles was also documented by Doutriaux (2004) in her survey of the middle Colca Valley near Lari. These data tentatively suggest that that modes of intra-valley complementarity or alliance formation were in place as early as approximately A.D.



1200, perhaps coeval with the development of shared material cultural practices that cross-cut ethnic boundaries, including the distinct style of ‘abutting’ *chullpas* which are the subject of this dissertation. Excavations of additional mortuary sites in both the upper and lower valley are necessary to evaluate the nature and scale of inter-ethnic interaction across time.

At present, the multi-ethnicity hypothesis is less tenable at Yuraq Qaqa, where modification technologies—in so far as they are discernible on the cranial vault—are broadly similar, despite differences in ultimate shape. No true tabular forms were found.<sup>70</sup> However, unmodified individuals continue to represent 20-46% of the tomb sample, even in the late-period contexts of Yuraq Qaqa where oblique modification predominates. The Late LIP Chamber 003, in particular, exemplifies the persistence of diversity within the broader temporal trend toward greater standardization. Here, unmodified crania outnumber those with oblique modification, and crania with erect forms constitute one-third of the modified sample (N = 15). The unique distribution of modification categories in this burial context may reflect a different social catchment than the other Late LIP chambers (027, 035) where oblique modification accounts for over 50% of all individuals. That Chamber 003, as part of a sequence of semi-circular chambers, is physically separate and architecturally distinct from Chambers 027 and 035 may also suggest that it was utilized by different social groups (Velasco and Rodríguez Sotomayor 2014).

As a heuristic, the corporate group and inter-group alliance hypotheses presume that different modification types (including “non-modification”) index distinct social “groups,” such that their integration in mortuary space would signify a profound statement of collapsed social distance. However, CVM as a social identifier may cross-cut social boundaries, such that the individuals buried together may still have conceived of themselves as a cohesive descent group,

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<sup>70</sup> Reconnaissance of looted tombs which were not excavated did not locate any crania of the tabular variety either.

real or imagined, regardless of diversity in head shape. In fact, biodistance results presented in the next chapter suggest that kinship groups may have included both modified and unmodified individuals. If so, we must reconsider the nature of social integration at Yuraq Qaqa: Do modified crania represent a categorically distinct “ethnicity” relative to unmodified crania? What other social models (beside “multi-ethnicity”) might account for the persistence of unmodified individuals in moderate frequencies and their co-burial with modified individuals?

One possibility is that the corporate group identity, materialized and made permanent by burial structures, was actually much more fluid in practice. The anthropological literature on house societies is instructive in this regard, emphasizing a practice-oriented approach to kinship, where corporate entities emerge through shared activities and exchange relationships and “descent and inheritance may flow through either or both parents depending on the circumstances” (Gillespie 2000: 7). Known structures of dual descent in Andean kinship strongly shapes Kurin’s (2012: 222-223; 2016b) approach to cranial modification, which explores how an indelible marker of identity articulates with a social structure (*ayllu*) that is fundamentally scalar and malleable. She suggests that modification *presence* signals a cross-cutting kinship category, such as “first-born children,” while modification *style* may have been reckoned through matrilineal descent. Kurin’s (2012; 2016) model is partly predicated on what she interprets as sex-specific differences in modification style, which are notably absent in the Colca Valley sample. Yet the conceptualization of cranial modification as embedded within—but also distinct from—corporate group identity dynamically bridges the corporate group and inter-group alliance models to demonstrate how corporate group organization need not be fundamentally exclusive, as it is sometimes characterized (Bloch 1981; Isbell 1997). Within the heterarchy of *ayllu*, cranial

modification could have provided a point of articulation between different kin-based groups and potentially facilitated coordination at higher levels of inclusiveness.

In the context of the Colca Valley, Mannheim et al. (in press) further this line of thinking and challenge the overemphasis on ethnicity through a combination of ethnographic, linguistic, and bioarchaeological evidence. In their view, the social identity ascribed by cranial modification fundamentally inheres in the *person*, who shares inner substance with specific *places* of origin. As individuals circulate in a political economy shaped by ecological differentiation, the ontological equation of language, place, and person allows for the stable maintenance of difference within single regions, or even households. In fact, Spanish chroniclers commented on the existence of composite households whose members spoke different languages depending on the social context (Mannheim 1991). Code-switching would allow for the mediation of linguistic difference, but it could not be similarly applied in the context of permanent body modification.

Thus, interdigitated social organization could explain the persistent diversity of modified and unmodified individuals in the Colca Valley, which in effect counteracted the move toward increasing standardization predicted by Torres-Rouff's (2003) model. As Mannheim et al. (in press) provocatively ask, "What does it mean when a woman with an elongated head walks alongside a group of women with flat heads, with a flat-headed child on her back?" The possibility that burial groups reflect "houses" of mixed composition is more fully examined in Chapter 8, where CVM data is integrated with other lines of bioarchaeological evidence that can shed light on ecological differentiation and mate choice, two additional and important elements of this political-economic model.

## Summary

Results from the analysis of cranial modification practices in the Colca Valley reveal that the local tradition of head binding was socially and temporally dynamic. Cranial modification was not practiced universally by all inhabitants of the upper valley, and the frequency of CVM transformed over time from the Early LIP to the Late LIP, as Collagua society became more internally differentiated and later incorporated into the Inka state. Increasing rates of cranial modification in general, and the oblique form of modification in particular, are consistent with findings from other regions of the Andes that show how CVM became more standardized and ubiquitous outside of the Cuzco valley during the 500 years prior to and encompassing Inka rule. However, the creation of “group distinctiveness”, as reflected in CVM, does not appear to be the direct result of state policy intended to assimilate subject populations into a homogenous ethnic group, in part because the increased prevalence of head shaping practices predates the period of Inka imperial expansion. Instead, CVM standardization probably emerged interactionally as Collagua elites negotiated and embodied their economic and political position vis-à-vis the nascent Inka state.

Finally, cranial modification data do not accord with a strict “corporate group” model that equates *ayllu* with distinct burial structures and cranial modification styles (Hoshowers, et al. 1995; Isbell 1997). To the contrary, that individuals with qualitatively different cranial modification styles were interred together at Sahuara in the Early LIP tentatively supports the inter-group alliance hypothesis and provides strong physical evidence that social boundaries between the Collaguas and Cabanas were permeable, at least during the 12<sup>th</sup> to 13<sup>th</sup> centuries. The presence of modified and unmodified crania at all burial chambers at both sites (except one case) may also signify the integration of distinct social groups through burial, but it is more

likely that tombs correspond to kinship groups in which not all members were chosen for cranial modification (see Chapter 6). In either event, the co-burial of modified and unmodified individuals suggests that mortuary politics worked to break down the social distinctions embodied in life by highlighting group cohesion over intra-group difference.

## CHAPTER 6

### BIODISTANCE

*“...Y en muriendo, ponían muy particular cuidado en respetar su cuerpo, tanto que lo adoraban por dios y como a tal le ofrecían sacrificios. Para esto, en saliendo el ánima del cuerpo, lo tomaban los de su ayllu y parcialidad, y si era rey o gran señor, lo embalsamaban y curaban con gran artificio, de suerte que se pudiese conservar entero sin oler mal ni corromperse por muchos años... Pero es de notar que no todos los vivos hacían veneración generalmente a todos los cuerpos muertos, ni todos sus parientes, más de aquellos que descendían dellos por línea recta. De manera que cada uno tenía cuenta con su padre, abuelo y bisabuelo hasta donde alcanzaba con la noticia; pero no la tenía con el hermano de su padre ni de su abuelo, ni se tenía ninguna con los que habían muerto sin dejar sucesión...”*

Bernabé Cobo, De la idolatría que tenían con sus difuntos (1653)

Bernabé Cobo’s description of the embalming, curation, and worship of ancestral corpses highlights two interrelated themes running through scholarship on late prehispanic *chullpas* and the ancestor cults which centered around them: First, that ancestor veneration was fundamentally based in the *ayllu*, a corporate group bound together by shared resources and descent from a common ancestor; and second, that the *ayllu*, and by extension *chullpa* organization, was structured by notions of group endogamy, to the exclusion of outside groups (DeLeonardis and Lau 2004; Isbell 1997; Mantha 2009; Salomon 1995). Although few scholars would argue that kinship was strictly reckoned strictly biologically (see Isbell 1997), biological structure is strongly implied, as reflected in Cobo’s description of patrilineal obligations to the mummified

corpse. Nevertheless, models linking *ayllu*, ancestor cult, and social exclusion—based in ethnohistoric observations decades if not centuries removed from the period under study—are rarely examined through the systematic analysis of human remains.

This chapter explores if and how above-ground sepulchers were structured biologically through biodistance analyses of cranial non-metric traits. The theoretical and methodological basis of these analyses are discussed in detail in Chapters 3 and 4, respectively. At the outset, descriptive results from data winnowing procedures are presented in order to derive the final trait lists used in inter-group and inter-individual analyses. The Mean Measure of Divergence (MMD) distance matrix is calculated between five burial groups using a 24-trait list and a 12-trait list. Crania from spatially proximate chambers (027 and 028; 051 and 054) were combined because of small sample sizes. In a separate analysis, the Jaccard coefficient was calculated to assess average inter-individual similarity within burial groups. Differences in inter-individual similarity between males and females are then analyzed to approximate postmarital residence practices, under the assumption that the sex exhibiting greater heterogeneity is the migratory sex (Spence 1974). In the discussion, results are evaluated in light of known models of Andean social organization and marriage exchange, namely the *ayllu*. Patterns of phenotypic variation are also used to evaluate scenarios of boundary maintenance via endogamy (corporate group model) or alliance formation via inter-marriage (inter-group alliance model).

### Data Screening Results

Five traits were excluded from the dataset prior to winnowing procedures because their presence or absence was effectively invariant across the study sample: PEFA, AT, OB,

FOROVA, and CONDFAC. Of the remaining traits, intra-observer differences between two independent scoring sessions of 22 crania were negligible.

### *Correlations with Age, Sex, and CVM*

Prior to calculating biological distances, potential associations between non-metric trait expression and age, sex, and CVM were explored through nonparametric tests of association (Table 6.1).<sup>71</sup> Four traits were significantly more frequent at or near the 0.001 level in males (MRGTUB OSINC, PAB) or females (IOSUT). Because these correlations were moderate to substantial (ranging in absolute value from 0.321-0.521), highly significant, and concordant with previous findings of sexual dimorphism in hyperstotic and hypostotic traits, they were excluded from biodistance analysis. Two additional traits were associated with females at or near the 0.05 level (METSUT, TD), but because these correlations are weak (-.214 and -0.194, respectively) and reports of sexual dimorphism in their expression are inconsistent (De Stefano, et al. 1984), they are retained for analysis.

No traits were correlated with age at a threshold of  $p < 0.001$ . Only one trait (OSJAP) correlates with ordinal age at the  $p < 0.01$  level (Spearman's  $\rho = -.241$ ,  $p < 0.005$ ), meaning that partial expression is more common among younger individuals. This trait was conservatively eliminated although there is no precedence in the literature for age difference in its expression. Broadly similar age distributions across Yuraq Qaqa and Sahuara further justify the retention of traits weakly correlated with age at the 0.05 level, as they are unlikely to influence results (Buikstra 1976).

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<sup>71</sup> Because data screening involves multiple comparisons, the Bonferroni correction was used to set the alpha level for statistical significance ( $0.05 / 38 = 0.001$ ). Following Blom (2005: 135), traits associated at  $p < 0.05$  were only removed if the associated trait “had formerly been identified as sexually dimorphic in other populations.”



Finally, three ossicles (COROSS, SAGOSS, and PNB) which were associated with modification category or degree at or below the 0.05 level were removed from analysis given the susceptibility of these traits to the extrinsic influence of CVM is well established (Konigsberg, et al. 1993; Van Arsdale and Clark 2012). Coronal ossicles exhibit a progressive and highly statistically significant association with modification degree ( $\rho = 0.298$ ,  $p = 0.002$ ), but not with category. Sagittal ossicles and parietal notch bone were statistically overrepresented among erect crania ( $\chi^2 = 12.084$ ,  $df = 3$ ,  $p = 0.007$ ,  $N = 106$ ), and oblique crania ( $\chi^2 = 8.249$ ,  $df = 3$ ,  $p = 0.041$ ,  $N = 143$ ), respectively.

Table 6.1. Tests of association of non-metric traits with ordinal age, sex, and CVM degree.

	Trait	Age (1-5)			Sex (M, F)			CVM (0-3)		
		$\rho$	Sig.	N	$\phi$	Sig.	N	$\rho$	Sig.	N
1	METSUT	-0.094	0.268	142	-0.214	0.035	97	0.149	0.078	141
2	SOF	-0.035	0.675	147	0.135	0.175	101	-0.019	0.818	146
3	SON	0.039	0.638	146	0.116	0.245	100	-0.028	0.741	145
4	STF	-0.061	0.467	145	0.082	0.410	100	-0.013	0.880	144
5	STN	0.073	0.387	144	-0.010	0.923	98	-0.105	0.211	143
6	IOSUT	-0.093	0.283	134	-0.526	<b>0.000</b>	96	0.142	0.103	133
7	IOF	0.019	0.832	134	0.050	0.621	96	-0.131	0.132	133
8	AEFE	-0.248	0.024	83	-0.122	0.394	49	-0.071	0.523	83
9	PEFA	.	.	140			96	.	.	139
10	ZYMAX	-0.095	0.272	135	0.182	0.077	95	-0.142	0.104	133
11	MRGTUB	0.019	0.821	144	0.366	<b>0.000</b>	99	-0.064	0.452	142
12	MZYF	-0.124	0.139	143	-0.029	0.773	98	0.067	0.429	141
13	OSJAP	-0.241	<b>0.005</b>	134	-0.108	0.296	93	-0.090	0.305	132
14	FTA	-0.042	0.629	134	-0.124	0.237	91	0.038	0.664	134
15	EB	-0.073	0.383	143	-0.560	0.574	99	0.051	0.544	142
16	AT	.	.	151			101	.	.	146
17	MASTFOR	-0.142	0.084	150	-0.020	0.844	101	-0.067	0.420	146
18	SQMMAST	-0.058	0.488	147	0.178	0.076	99	0.037	0.662	143
19	PNB	-0.046	0.583	147	-0.144	0.153	98	0.117	0.164	143
20	AB	-0.129	0.121	145	0.089	0.373	100	-0.017	0.842	142
21	OSSOMS	-0.104	0.220	141	0.049	0.630	95	-0.090	0.295	138
22	PF	0.205	0.014	142	-0.550	0.583	99	0.021	0.803	141

Trait	Age (1-5)			Sex (M, F)			CVM (0-3)		
	rho	Sig.	N	phi	Sig.	N	rho	Sig.	N
23 COROSS	-0.062	0.534	102	-0.142	0.237	69	0.298	<b>0.002</b>	102
24 OB	.	.	114			79	.	.	114
25 SAGOSS	0.027	0.784	107	0.149	0.199	74	0.076	0.440	106
26 OL	-0.152	0.083	132	-0.151	0.152	90	-0.064	0.469	130
27 LO	-0.026	0.766	135	-0.032	0.759	92	-0.019	0.828	132
28 OSINC	0.012	0.887	142	0.333	<b>0.001</b>	98	0.021	0.804	139
29 OCCFOR	0.014	0.874	135	0.069	0.510	92	-0.016	0.855	132
30 PCF	-0.184	0.031	138	0.065	0.528	93	0.012	0.894	135
31 CONDFAC	-0.126	0.193	109	0.132	0.251	76	-0.106	0.277	107
32 PP	0.016	0.860	131	0.026	0.807	89	0.036	0.683	128
33 APICOSS	-0.003	0.977	107	-0.098	0.391	76	-0.010	0.920	106
34 DHC	-0.020	0.821	134	-0.101	0.336	91	0.037	0.676	130
35 FOROVA	.	.	145			97	.	.	140
36 FORSPI	-0.018	0.834	144	-0.106	0.300	96	-0.050	0.558	139
37 FORVES	0.100	0.233	145	-0.036	0.724	97	0.093	0.273	140
38 PSB	-0.070	0.413	140	0.138	0.184	93	-0.028	0.746	136
39 PAB	0.028	0.738	145	0.321	<b>0.002</b>	97	0.097	0.254	140
40 TD	0.128	0.127	144	-0.194	0.057	96	-0.090	0.292	140
41 ALPF	0.141	0.103	135	-0.020	0.850	94	0.100	0.250	133
42 PT	0.002	0.982	128	-0.087	0.408	90	-0.097	0.279	126
43 MT	-0.100	0.305	107	0.012	0.922	73	-0.004	0.968	105

Values in **bold** are significant at the 0.01 level.

### *Inter-Trait Correlations*

Of the 703 pairwise calculations of the phi coefficient that were run to assess inter-trait correlation, 48 were significantly correlated below the 0.05 level.<sup>72</sup> Because of the high probability of type I error associated with multiple comparisons, seven associations below the 0.01 level are expected to occur by chance. In fact, 15 pairs are significantly associated at that threshold, six of which yield p-values less than 0.001, suggesting that inter-trait correlation is a

<sup>72</sup> However, 21 of these associations are irrelevant to the data winnowing procedure since they involve one or more traits which are significantly associated with age, sex or CVM.

significant factor in the dataset.<sup>73</sup> Traits were removed from the dataset in a stepwise fashion. Comparisons involving traits that were already shown to have a significant association with age, sex, or CVM were disregarded at the outset. Traits involved in multiple associations were then eliminated. When two inter-correlated traits were involved in one or the same number of associations, the trait with no known heritability studies, less discriminatory power, or lower variability (in that order) was removed (cf. Molto 1983).

The following pairs were significantly associated at the 0.001 level: SOF/SO, SOF/STF, OSJAP/OSSOMS, EB/AB, AB/OSSOMS, and OCCFOR/MT. The highly significant negative correlation between supraorbital foramina (SOF) and notches (SON) is probably due to the fact that these traits represent alternative expressions of a single underlying variable. Because SOF was involved in multiple significant associations, it was removed from the trait list.<sup>74</sup> The correlation between OSJAP and OSSOMS is a non-factor because the former is excluded on the basis of age correlation. Next, EB, AB, and OSSOMS represent an inter-correlated cluster of developmentally similar traits. In particular, AB and OSSOMS are located proximally to one another and have been shown to be heritable (Hauser and De Stefano 1989). Of the three, only OSSOMS was retained in the final trait list because it is a discriminatory trait (see discussion in subsequent section).<sup>75</sup> Finally, the association between MT and OCCFOR is probably spurious since they are neither topographically close nor developmentally similar. In keeping with protocol, MT was eliminated because it is the less variable trait, with only 3 occurrences across the entire sample.

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<sup>73</sup> Four of 15 pairs include one or more traits which were significantly associated with age, sex, or CVM. Even so, 11 associations with  $p < 0.01$  is over 50% more than the number of associations expected by chance.

<sup>74</sup> The positive association between SOF and STF has a strong basis in published literature, further justifying the exclusion of the former (see citations in Hauser & DeStefano 1989: 51).

<sup>75</sup> EB is also discriminatory, but occurs at a frequency less than five percent. Selecting OSSOMS over AB, the least rare of the three traits, does not significantly influence the results reported in this chapter.

Subsequent to the removal of SOF, EB, AB, and MT, only 3 pairs of traits remained significantly correlated at the 0.01 level: SON/MZYF ( $\phi = 0.266$ ), STN/FORSPI ( $\phi = 0.263$ ), and IOF/MYZF ( $\phi = 0.236$ ). MYZF was removed to avoid redundancy since it is developmentally similar and regionally proximate to IOF, but the less variable trait.<sup>76</sup> The correlation between FORSPI and STN is likely due to chance since there is no underlying rationale for their association. Accordingly, both traits were retained for analysis. Finally, of the 7 trait pairs correlated at the 0.05 level (SON/STF, SON/ALPF, IOF/MASTFOR, IOF/DHC, MASTFOR/SQMMAST, OCCFOR/FORSPI, and TD/ALPF), only MASTFOR/SQMMAST and SON/STF merit closer scrutiny because they respectively share a common regional origin. MASTFOR was selected over SQMMAST because it is the more variable trait. The negative correlation between SON/STF can be disregarded since it indicates that the traits are actually independent of one another (Brown 2013). All remaining trait pairs are included since they only exhibit weak associations (absolute value  $\phi \leq 0.203$ ), which “will not seriously distort MMD results” (Harris and Sjøvold 2004: 84).

In sum, five traits were eliminated because of statistically significant and presumably meaningful inter-trait correlations: SOF, AB, MT, MYZF, and SQMMAST.

### *Non-Contributory Traits*

Traits that do not vary significantly in pairwise group comparisons or that are nearly fixed across a population (i.e., low frequency) can be considered “non-contributory” because they do not help discriminate between groups (Harris and Sjøvold 2004; Irish 2010). Among all samples, the following traits exhibit frequencies below five percent: FTA, EB, SQMMAST, PP,

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<sup>76</sup> MZYF is also significantly associated with multiple traits at the 0.01 level and 0.05 level, further warranting its exclusion.

APICOSS, PT, and MT. An additional 15 traits (METSUT, STF, AEFEE, MRGTUB, OSJAP, PNB, AB, PF, COROSS, SAGOSS, LO, OSINC, OCCFOR, FORVES, PSB) did not vary significantly in pairwise comparisons between burial groups. Of these 21 non-contributory traits, 9 had been excluded by a previous step in the data winnowing procedure, leaving the status of 12 non-contributory traits to be resolved.

Irish (2010: 383) cautions that the omission of these traits “may overemphasize divergence among groups that are, in reality, closely related.” This is of special concern for intra- and inter-cemetery analyses, since a regional population is already expected to share many heritable traits. Therefore, this study will conduct MMD analysis with and without non-contributory traits in the final trait list. All traits retained in analysis, whether or not they are contributory, are indicated in Table 6.2.

Table 6.2. List of traits used in biological distance analysis.

	Trait	Abbreviation
1*	Metopic Suture	METSUT
3	Supraorbital notch	SON
4*	Supratrochlear foramen	STF
5	Supratrochlear notch	STN
7	Multiple infraorbital foramina	IOF
8*	Anterior ethmoid foramen exsutural	AEFE
10	Zygomaxillary tuberosity	ZYMAX
14*	Fronto-temporal articulation	FTA
17	Mastoid foramen	MASTFOR
21	Ossicle at occipito-mastoid suture	OSSOMS
22*	Parietal foramen	PF
26	Ossicle at lambda (apical bone)	OL
27*	Lambdoidal ossicles	LO
29*	Occipital foramen	OCCFOR
30	Condylar canal patent	PCF
32*	Paramastoid process	PP
33*	Ossified apical ligament	APICOSS
34	Divided hypoglossal canal	DHC
36	Foreman spinosum incomplete	FORSPI
37*	Foramen of Vesalius	FORVES
38*	Pterygo-spinous bridge	PSB
40	Tympanic dehiscence	TD
41	Accessory lesser palatine foramina	ALPF
42*	Palatine torus	PT

\* Non-contributory trait

Table 6.3. Samples used in biological distance analysis.

Site	Sector	Group Code <sup>a</sup>	Chamber	Time Period	N
Sahuara	--	SH_118	--	Early LIP	51
Yuraq Qaqa	I	YQ_3	003	Late LIP	23
Yuraq Qaqa	I	YQ_27	027	Late LIP	10
Yuraq Qaqa	I		028	Early LIP	3
Yuraq Qaqa	II	YQ_35	035	Late LIP	53
Yuraq Qaqa	III	YQ_51	051	Early LIP	4
Yuraq Qaqa	III		054	Early LIP	8
Total					152

<sup>a</sup> Samples from Chambers 027 & 028 and Chambers 051 & 054, respectively, are combined due to small sample sizes.

## Biological Distance Results I: Inter-Group Differentiation

The Mean Measure of Divergence (MMD) was calculated between each burial group using the R script provided by Sołtysiak (2011). The Anscombe transformation was used. MMD matrices were derived from two different, but overlapping, trait lists: Table 6.4 presents MMD values for the five burial groups using 24 uncorrelated traits. Table 6.5 presents MMD values for the same pairwise comparisons when only the 12 contributory traits are used in analysis.

Table 6.4. MMD matrix (below diagonal) and standard deviation (above diagonal) for inter-tomb comparison based on 24 cranial traits.

Group	YQ_3	YQ_27	YQ_35	YQ_51	SH_118
YQ_3	0	0.0387	0.0202	0.0464	0.0204
YQ_27	0.0544	0	0.0311	0.0572	0.0313
YQ_35	<b>0.0672</b>	0.0302	0	0.0390	0.0129
YQ_51	0.0068	0.0090	0.0182	0	0.0391
SH_118	<b>0.0838</b>	0.0255	<b>0.0757</b>	0.0310	0

MMD values in **bold** are significant at 0.001 level.

Table 6.5. MMD matrix (below diagonal) and standard deviation (above diagonal) for inter-tomb comparison based on 12 traits.

Group	YQ_3	YQ_27	YQ_35	YQ_51	SH_118
YQ_3	0.0000	0.0518	0.0272	0.0582	0.0274
YQ_27	<b>0.1682</b>	0.0000	0.0417	0.0725	0.0419
YQ_35	<b>0.1652</b>	<b>0.1022</b>	0.0000	0.0481	0.0173
YQ_51	0.0496	0.0555	0.0897	0.0000	0.0483
SH_118	<b>0.1897</b>	0.0401	<b>0.1557</b>	0.0651	0.0000

MMD values in **bold** are significant (i.e., MMD exceeds twice its standard deviation).

Both matrices yield similar results, especially for the pairwise comparisons involving groups with  $N \geq 20$ . MMD distances between YQ\_3, YQ\_35, and YQ\_118 are significantly larger than expected, regardless of whether or not non-contributory traits are included in the

analysis. These distances exceed twice the standard deviation and are highly statistically significant ( $p < 0.001$ ) when p-values are “estimated using two-sided Z-scores counted as  $MMD/SD$ ” (Sołtysiak 2011). Univariate differences in the frequency of ZYMAX, OL, DHC, FORSPI, and ALPF drive the divergence of YQ\_3 and YQ\_35. Ossicle at lambda (OL), which is present on nearly half of the individuals in YQ\_3, also differentiates that burial group from Sahuara (SH\_118), along with IOF, MASTFOR and OCCFOR. SH\_118 and YQ\_35, which make up the largest samples for the Early and Late LIP, respectively, are primarily differentiated by SON, STN, IOF, OSSOMS, and DHC.

The “combined” groups, YQ\_27 and YQ\_51, which are the smallest samples included in the analysis ( $n \leq 13$ ), do not significantly diverge from other burial groups in the 24-trait analysis. The average MMD of YQ\_51 with other burial groups from Yuraq Qaqa is small relative to other pairwise comparisons (0.0113). The distance between YQ\_51 and SH\_118 is slightly larger, but not greater than expected if both samples represent a single biological population.

When only contributory traits are considered, YQ\_51 remains statistically indistinguishable from other burial groups. YQ\_27, however, diverges significantly from YQ\_3 and YQ\_35 (MMD = 0.1682 and 0.1022, respectively), the burial groups located nearest to it. Conversely, the distance between YQ\_27 and SH\_118 is relatively small (0.0401). This result is also notable since the correction for small sample size makes statistical significance more difficult to achieve. The divergence of YQ\_27 from YQ\_3 and YQ\_35 is primarily driven by three traits which are especially prevalent in the first group: IOF (70%,  $N = 10$ ), MASTFOR (69.2%,  $N = 13$ ), and TD (100%,  $N = 13$ ).



Multi-dimensional scaling (MDS, Procedure Alscal) was used to visualize inter-group distances for the 12-trait analysis in two dimensions (Figure 6.1). The resulting MDS plot has a low stress value of 0.06699 (Kruskal's stress formula 1) and  $r^2 = 0.95997$ , meaning that a large proportion of variance in the scaled data is accounted for by their corresponding distances (SPSS 19.0). Figure 6.1 clearly illustrates the divergence of spatially proximate tombs (YQ\_27, YQ\_3, and YQ\_35) and the separation of Sahuara from the largest single-context samples at Yuraq Qaqa. Notably, YQ\_35 is farthest from other groups on the second dimension. YQ\_3 is an outlier on the first dimension.

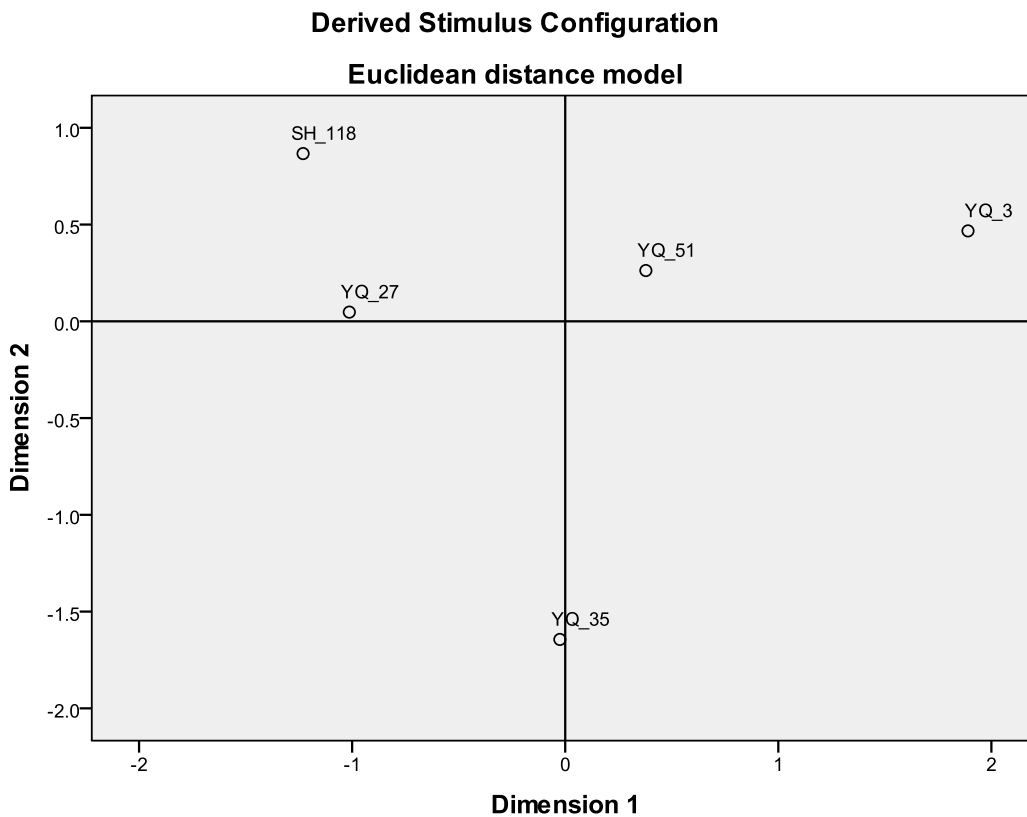


Figure 6.1. Two-dimensional MDS for 12-trait MMD distances between burial groups at Yuraq Qaqa ('YQ') and Sahuara ('SH').

## Biological Distance Results II: Within-Group Heterogeneity

To explore group-specific patterns of phenotypic variability, two cumulative indices based on the Jaccard coefficient were calculated, Triangular Cumulative Similarity (TCS) and Square Cumulative Similarity (SCS), which respectively sum the Jaccard coefficients within a group and between two groups, respectively. Theoretically, greater within-group homogeneity is indicated when  $TCS > SCS$ . In this biodistance analysis, groups based on burial group and sex were analyzed to explore if patterns of variability differ between males and females, which could suggest social organization based on virilocality or uxorlocality (Spence 1974; Stojanowski and Schillaci 2006). Only the list of discriminatory traits was used for this exploratory analysis because high frequency, non-discriminatory traits, such as AEFÉ and PF can artificially inflate similarity.

Table 6.6. TCS values by burial group and sex, based on 12 traits.

Group	TCS fraction	TCS%
SH_118	4114/8728	0.4713566
Males (N = 18)	486/1050	0.4628571
Females (N = 26)	1170/2312	0.5060554
YQ_3	846/1903	0.4445612
Males (N = 11)	194/438	0.4429224
Females (N = 10)	126/289	0.4359862
YQ_27	341/616	0.5535714
Males (N = 7)	95/159	0.5974843
Females (N = 5)	42/84	0.5
YQ_35	3280/7848	0.4179409
Males (N = 19)	402/966	0.4161491
Females (N = 30)	1060/2519	0.4208019
YQ_51/54	226/467	0.48394
Males (N = 5)	37/67	0.5522388
Females (N = 7)	70/150	0.4666667
Yuraq Qaqa, all males	2589/5986	0.4325092
<Group 35 excluded>	955/1960	0.4872449
<Early LIP only>	87/153	0.5686275
Yuraq Qaqa, all females	3697/8435	0.4382928
<Group 35 excluded>	754/1656	0.455314

Table 6.7. SCS values.

Between-Group	SCS fraction	SCS%
YQ_3—YQ_27	1106/2378	0.465097
YQ_3—YQ_35	3317/8188	<b>0.405105</b>
YQ_3—YQ_51	907/2036	0.445481
YQ_3—SH_118	3619/8674	<b>0.417224</b>
YQ_27—YQ_35	1725/3242	0.532079
YQ_27—YQ_51	603/1189	0.507149
YQ_27—SH_118	2476/4915	0.503764
YQ_35—YQ_51	1825/4136	0.441248
YQ_35—YQ_118	7173/17377	<b>0.411061</b>
YQ_51—YQ_118	2008/4331	<b>0.463634</b>

Values in **bold** are less than the TCS values of the groups compared. All other SCS values exceed only one TCS value in each pair.

Patterns of variability within and between burial groups generally conform to expectations for a kinship-structured cemetery. TCS values for SH\_118, YQ\_3, and YQ\_35 (0.418-0.484) are greater than the SCS values of these groups compared to one another (0.405-0.417), although in the case of YQ\_35, the TCS-SCS difference is very small (Table 6.6 and Table 6.7). YQ\_27 exhibits the highest TCS value of all samples (0.5535714). Similarity within the sample always exceeds SCS values with other groups, although the converse is not true. For example, the SCS value for the comparison of individuals from YQ\_3 and YQ\_27 is 0.465097, which is considerably lower than the TCS of the latter, but higher than the TCS of the former. Finally, YQ\_51 exhibits the second highest TCS value (0.48394), which is greater than the resulting SCS values for its comparison with YQ\_3, YQ\_35, and SH\_118, but not YQ\_27.

The TCS values for comparisons by sex provide conflicting results with respect to postmarital residence practices within Colca Valley society.<sup>77</sup> When all samples from Yuraq

<sup>77</sup> SCS values for males and females are not calculated between all possible pairwise comparisons because multiple differences between burial groups in regard to which sex, if either, is more homogenous confounds expectations for between-group variability. Temporal differences between burial groups also undermine the assumption that “samples included for study are derived from contemporaneous populations” (Stojanowski and Schillaci 2006: 67).

Qaqa are pooled, there is virtually no difference in sex-specific variability; TCS values between males and females differ only by 0.006 (Table 6.6). However, when individuals from Chamber 035, which exhibit the lowest TCS values, are excluded from calculations, results are more consistent with a scenario of virilocality, in which greater phenotypic homogeneity is expected among closely related males who remain in their natal territory after marriage. Especially in YQ\_27 and YQ\_51, TCS values are nearly 0.1 points greater for males than females.

However, at Sahuara, the patterns are reversed: TCS is greater for females than males (0.5060554 vs. 0.4628571), suggesting that males were the migratory sex. If males were the migratory sex, then inter-cemetery comparisons between contemporaneous populations should indicate “relative homogeneity because male residence mobility within a network will emanate from a limited number of common sources” (Stojanowski and Schillaci 2006: 67). To evaluate this proposition, the between-group similarity of Early LIP males from Yuraq Qaqa (N =7) and Sahuara (N = 18) was calculated, resulting in the SCS value of 0.486. SCS exceeds the TCS value for males at Sahuara, as expected, but is considerably lower than the TCS value of Early LIP males at Yuraq Qaqa (0.569). This comparison should be interpreted cautiously given that the Early LIP sample at Yuraq Qaqa is very small, and its constituent TCS values are at odds with the pattern of variability observed at Sahuara.

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As Konigsberg (1987: 477) notes, “it is virtually impossible to delineate mating networks in prehistoric samples (which would be required in most between-group analyses)” (Konigsberg 1987: 477). Accordingly, the present study of postmarital residence focuses primarily on within-group, between-sex variability.

Table 6.8. TCS values by modification presence (YQ\_35 and SH\_118 only)

Group		TCS fraction	TCS%
YQ_35 Modified	(N = 38)	1515/3732	0.4059486
Males	(N = 14)	198/479	0.4133612
Females	(N = 24)	596/1463	0.4073821
YQ_35 Unmodified	(N = 11)	193/398	0.4849246
Males	(N = 5)	32/67	0.4776119
Females	(N = 6)	56/117	0.4786325
SH_118 Modified	(N = 21)	798/1537	0.5191932
Males	(N = 7)	67/142	0.471831
Females	(N = 14)	379/701	0.5406562
SH_118 Unmodified	(N = 23)	740/1699	0.4355503
Males	(N = 11)	170/384	0.4427083
Females	(N = 12)	191/427	0.4473068

TCS values for modified and unmodified subgroups do not include individuals of indeterminate sex.

To further explore anomalous patterns of inter-sex and within-group variation, male and female TCS values were calculated for modified and unmodified subgroups from Sahuara and Chamber 035 at Yuraq Qaqa, the largest single-context samples. Greater homogeneity among modified females at Sahuara (TCS = 0.541), relative to modified males (TCS = 0.472), drives the pattern of uxorlocality outlined above (Table 6.8). When only unmodified individuals are considered, male and female TCS scores at Sahuara are virtually indistinguishable, but consistently lower than similarity measures among modified individuals. A disparity in the TCS values of modified and unmodified subgroups from Chamber 035 is also observed, but not in the same direction. Modified males and females are more heterogeneous (i.e., lower TCS values) than unmodified males and females.

Although these results are provocative, they must be approached cautiously given the susceptibility of the Jaccard coefficient to sample size fluctuations (Duncan 2011). The highest and lowest TCS values are typically observed among smaller and larger samples, respectively. For example, modified individuals greatly outnumber unmodified individuals within YQ\_35 by

about 3.5 to 1, and the smaller group appears more “homogenous.” Recall also that the highest TCS values by burial group are within samples numbering fewer than 15 individuals. However, the relationship between sample size and TCS is not straightforward. For example, male and female TCS scores for YQ\_35 and SH\_118 show that both sexes at the latter site are more homogenous overall, even though the sample sizes are roughly equivalent. Sahuara also exhibits a relatively high overall TCS value, despite being the second largest sample in the study.

The low TCS values among YQ\_35 individuals overall, and modified individuals in particular, should be approached cautiously given that the Jaccard coefficient only counts the shared presence of a trait between two individuals, rather than their shared absence. This is of concern for traits where absence of one trait may be the result of an equally meaningful alternative expression (SON vs. SOF) or where it is actually the rarer phenotype in a population (TD, PCF, ALPF). In fact, individuals from Chamber 035 exhibit the lowest rate of SON (49%, N = 51; compared to the population mean of 63%, N = 145), but high rates of SOF (82.4%, N = 51), and are more likely to express the rarer phenotype for ALPF (i.e. a single lesser palatine foramen). In essence, lower frequencies of trait presence would drive down the TCS value, even if shared absence distinguishes the group from others. This presents the possibility that the low TCS values for YQ\_35 may be partly an artifact of the mathematical properties of the Jaccard coefficient, rather than a true approximation of underlying biological heterogeneity.

Nevertheless, eight of the 12 traits used in the final analysis exhibit frequencies less than 50%, which justifies the use of the Jaccard coefficient (Spence 1974). Using a formula which includes negative matches would simply bias results in the opposite direction. Future work will explore the use of weighted distance measures in intra-cemetery biological distance analysis, which may circumvent the shortcomings inherent in the Jaccard coefficient.

## Discussion

Biodistance analysis of cranial non-metric traits was utilized to test two key propositions regarding the kinship structure of *chullpa* cemeteries: 1) that burial groups represent endogamous biological groupings, as predicted by the corporate group model; and, 2) that communal mortuary sepulchers promoted inter-group exchange and marriage alliance, which could be suggested by sex-specific patterns of phenotypic variation. Results show that cranial non-metric traits are strongly patterned on burial location. However, phenotypic variability, when partitioned by sex, does not yield consistent results across all mortuary contexts.

### *Kinship and Cemetery Structure*

With regard to hypothesis 1, statistically significant distances in the MMD analysis, as well as higher TCS values relative to SCS values, suggest that YQ\_3, YQ\_35, and SH\_118 represent biologically distinct subgroups. Because this pattern was recognized by two distinct statistical measures, which variably focus on inter-group differences (MMD) and inter-individual similarity (Jaccard), it is considered robust. Furthermore, these three burial groups represent the largest samples in the study. The consistent finding of biological differentiation between them presents the possibility that inconsistent or nonsignificant results from the comparison of smaller samples (YQ\_27, YQ\_51) to these mortuary contexts and to one another may be due to sample size limitations.

Still, a strong signal of within-group homogeneity in these smaller groupings, exceeding between-group similarity in most pairwise comparisons, is consistent with expectations for kin-structured burial (Spence 1974; Stojanowski and Schillaci 2006). YQ\_27 also shows a

statistically significant divergence from other late-period burial groups at Yuraq Qaqa, when only discriminatory traits are considered. High TCS values for Y1\_27 and YQ\_51, which include fewer individuals, would be expected if those individuals were closely related. On the other end of the spectrum, tombs with a larger number of individuals may have encompassed multiple related lineages, which would theoretically “dilute” within-tomb homogeneity, even if individuals buried together are on average more similar than individuals buried apart. The relationship between within-tomb variability and number of individuals (as a proxy for number of lineages) should not be overstated, since higher or lower TCS values may simply be an artifact of sample size and not representative of underlying variation.

Accepting the limitations of these statistics, we may ask how patterns of phenotypic variation accord with known archaeological and ethnohistoric parameters, such a geographic location, settlement organization, and chronology. Significant biological distance between Sahuara (SH\_118) and the two largest burial groups at Yuraq Qaqa (YQ\_3, YQ\_35) is not surprising, since these samples would by definition pertain to separate “biological populations” given their temporal associations (Harris and Sjøvold 2004); Sahuara dates to the Early LIP, while YQ\_3 and YQ\_35 are late-period contexts (Table 6.3).

Biological differentiation between Sahuara and Yuraq Qaqa also converges with other lines of evidence that suggest these two cemeteries were used by distinct social groups, making it less likely that inter-cemetery phenotypic divergence is solely the result of genetic drift. Recall that Yuraq Qaqa and Sahuara are located to the west and east of the Chillihuitira River, which separated irrigation networks, *ayllu* landholdings, and residence patterns during the late prehispanic period (Wernke 2013). The finding of biological distance across this important social



and hydrological boundary broadly supports a corporate group model, in which mortuary divisions reinforce the land tenure rights and resource claims of competing lineages.

Further, biological differentiation between temporally associated groups is consistent with the widely held, but rarely tested, notion that late prehispanic mortuary sepulchers were exclusive to Andean *ayllus*, social groups organized around a shared resource base and descent from a common ancestor (Isbell 1997). While Isbell (1997) downplays “actual biological descent” in favor of a more flexible “idiom of kinship,” most scholars nonetheless characterize the Andean *ayllu* as ideally endogamous (Cook 2007; Platt 1986; Salomon 1995). The present study supports a scenario in which Colca Valley social groups were mostly endogamous (c.f. Prowse and Lovell 1996; Sutter and Mertz 2004). This is not to say that marriage alliance and social relationships of fictive (non-biological) kinship, central elements of Andean social organization, were not important in Collagua society. Rather, this study provides evidence that the social practices of *ayllus* had observable effects on phenotypic variation within a relatively circumscribed area. The finding that mortuary practices were patterned on biological kinship is also supported by a recent aDNA study of skeletal remains from the late prehispanic site of Tompullo 2, located in the region immediately west of the Collaguas province (Baca, et al. 2012).

#### *Postmarital Residence Practices*

With regard to hypothesis 2, inconsistent results in the comparison of within-sex variability (TCS) limit the interpretation of residence practices at Yuraq Qaqa and Sahuara. YQ\_27 and YQ\_51 exhibit greater male homogeneity, SH\_118 exhibits greater female homogeneity, and within YQ\_3 and YQ\_35, sex-specific differences are negligible. Differential

patterns of phenotypic variation between modified and unmodified subsets from Sahuara and Chamber 035 at Yuraq Qaqa present the possibility that post-marital residence practices may have been influenced by the social affiliation group marked by CVM, but the direction of variability is inconsistent. The cacophony of results provides little support for residence practices common across groups at a given site or time period. If sex-specific migration into the Colca Valley originated “from a limited number of common sources”—which is implied by theoretical migration models—then we would expect the incorporation of outsiders to have a homogenizing effect on between-group differentiation (Stojanowski and Schillaci 2006: 67). This is clearly not the case here.

Ethnohistoric data on Andean marriage patterns attest to intra-community diversity in endogamy and exogamy practices, which could confound bioarchaeological correlates of post-marital-residence. Among the Kaatans of Bolivia, virilocality is the norm, but endogamy and exogamy coexist (Bastien 1978: 115-116).<sup>78</sup> More importantly, marriage between individuals from the same hamlet can be symbolically perceived as the exchange of marriage partners between two ‘structural levels’ of society, representing the highlands and lowlands. In other words, endogamy (etically defined) may be socially experienced as exogamy. The scalar nature of *ayllu* also means that endogamy and exogamy are always operating in tandem, since marriage partners from different ‘structural levels’ or moieties may belong to the same maximal *ayllu*.

In light of this variability, what empirical models could accommodate a pattern of group endogamy, but also inter-group difference in sex-specific phenotypic variation? One possibility is that mate choice was structured by *ayllu* affiliation, resulting in non-random migration into the Colca Valley. In other words, outsiders were neither randomly distributed among social groups

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<sup>78</sup> Although postmarital residence is predominantly virilocal, women inherit land upon returning to mother’s natal community via marriage (Bastien 1978: 119).

nor (necessarily) emanating from “common sources.” Williams-Blangero (1989: 143) empirically demonstrates how kin-structured migration “can actually increase differentiation between subdivisions.” This is due to related individuals migrating in pairs or groups, which is particularly common in fission-fusion societies (Fix 1978; Fix 2004).

The kin-structured migration model is applicable to the segmentary system of *ayllu*, in which related individuals are dispersed across different ecological zones and highly mobile. Marriage between individuals of different ecological zones or ‘structural levels’ of society (sensu Bastien 1978), but within the same *ayllu*, would maintain between-group differentiation. However, the distribution of migrants across society would be non-random, and the contribution of migration to group composition could potentially be unequal between *ayllus*, based on differences in rank, access to land in other regions, and extra-local connections more broadly (Cock Carrasco 1977; Wernke 2013). Perhaps the higher degree of variability among individuals buried in Chamber 035, one of the largest and most elaborate tombs, indicates the incorporation of migrants from dispersed hamlets—particularly those exhibiting CVM—into the mortuary group.<sup>79</sup>

At this stage of analysis, these hypotheses are provisional and require formal testing. Kin- or clan-specific migration provides a heuristic model for understanding heterogeneity within groups overall and subgroups based on sex or cranial modification. Yet, fluctuations in within-group TCS values may ultimately be due to the statistical properties of the Jaccard coefficient and differing sample sizes. The difficulties inherent in reconstructing mating networks in the past also caution against an encompassing interpretation of sex-specific variability in the Colca

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<sup>79</sup> However, it would be simplistic to say that all modified individuals represent ‘outsiders.’ The heterogeneity of modified persons from YQ\_35 is at odds with higher TCS values for all other modified individuals from the Late LIP (0.464, N = 17) and modified individuals at Sahuara. Genetic diversity within and between CVM subgroups is a potential avenue of future research.

Valley. From the available data, what can be stated confidently is that patterns of variation are not congruent with theoretical models of virilocality and uxorlocality. A more robust understanding of inter-group relationships and migratory practices in the Colca Valley must wait further testing using additional samples and methods, such as aDNA and strontium isotope analysis.

## Summary

Despite their respective limitations, two different statistical tests produce results that show inter-group phenotypic differences are patterned on burial location. This suggests that highly visible mortuary practices in the late prehispanic Andes, involving the mummification and entombment of ancestral corpses, reinforced structural differences between (mostly) endogamous social groups. As such, this study supports a corporate group model of burial organization, which has been widely applied to late prehispanic *chullpas* and *ayllus*, but rarely validated empirically. The analysis of post-marital residence is inconclusive, as male and female within-group variation does not conform to traditional migration models, where the migratory sex exhibits strong within-group heterogeneity but between-group homogeneity. If migration was significant, it did not have a homogenizing effect on phenotypic variation. Kin-structured migration, within the segmentary *ayllu* system, was offered as a heuristic model to conceptualize incongruent patterns of subgroup variation across mortuary groups. Ultimately, the nature of migration into the Colca Valley remains an unresolved question.

The biodistance analyses presented in this chapter do not incorporate population genetic models. While they are strongly suggestive of between-group differentiation, they should be considered provisional, in light of the “fuzzy limits” of biodistance and small sample sizes

involved (Stojanowski and Schillaci 2006). Future work with additional samples inside and outside of the Colca Valley can further clarify the degree and significance of biological differentiation within this relatively circumscribed area.

## CHAPTER 7

### STABLE ISOTOPE ANALYSIS

*“En la manera de vivir tienen su trato y comercio, entre éstos desta provincia, los que tienen comida la dan a los que no la tienen a trueco de ganado, lana y otras cosas de rescate, y entre las provincias sus vecinas, van las que abundan de una cosa a rescatar con ella lo que falta (así); y desta manera cada uno se previene como gente de razón.”*

Juan de Ulloa Mogollón, Relación de la Provincia de Los Collaguas (1586)

Ulloa Mogollón provides an idyllic account of economic barter in the Colca Valley and neighboring provinces; those who hold one resource in excess trade it for another they lack. In a later passage, he specifies that livestock raised in the high sierra would be exchanged for maize and quinoa grown in the lower valley. This picture of inter-zonal resource exchange accords well with widely invoked concept of vertical complementarity in the Andes (Murra 1975), but it is at odds with other indicators of social and economic asymmetry that suggest resources were not equally distributed across Colca Valley society (Wernke 2013). Stable isotope analysis provides an independent line of evidence that can directly characterize patterns of consumption and indirectly assess patterns of resource access and exchange. If maize and camelid meat were indeed staple food items in the prehispanic era, how did consumption of these resources vary across the population and over time? What role did mortuary practices play in consolidating social and economic ties between and among corporate groups or intermediate elites? Does diet in the Colca Valley covary with other indices of social identity, such as burial location, cranial vault modification (CVM), and skeletal sex?

To address these questions, stable isotope analysis of carbon and nitrogen was conducted on bone collagen from a representative subset of adult individuals (N = 46). This chapter presents the results from these analyses and explores differences between groups based on age, sex, CVM, burial location, and time period. In the discussion, overall dietary patterns will also be compared against ethnohistoric models of resource access and subsistence specialization in the Colca Valley. Next, inter- and intra-cemetery variability in stable carbon and nitrogen isotope ratios are used to evaluate the corporate group and inter-group alliance models of mortuary practice, which carry distinct implications for strategies of resource control and exchange. Because these models inadequately explain observed dietary patterns, in the final section, I propose a more dynamic social model that addresses the two most significant sources of variation in stable carbon and nitrogen values—sex and cranial vault modification (CVM)—and how they transform over time.

## Results

### *Sample Preservation*

Atomic carbon to nitrogen (C:N) ratios for all bone collagen samples fall within the acceptable range of 2.9 - 3.5 (Ambrose 1990). Average atomic C:N values, percent carbon (%C), and percent nitrogen (%N) for each site are presented in Table 7.1. Carbon and nitrogen stable isotope data for each individual are presented in Table 7.2. Although average preservation values exceed acceptable thresholds, some samples have elemental concentrations under 30% and 10% (for carbon and nitrogen, respectively), which Finucane et al. (2006) use as grounds for exclusion from analysis. In the present study, these samples are retained, following Ambrose (1990: 447) who defines C and N concentrations above 13% and 4.8% as indicative of human

bone “containing well-preserved collagen.” This is consistent with protocols employed by other isotopic studies in the Andes (Knudson, et al. 2007; Tomczak 2001; Torres-Rouff, et al. 2015). Overall, the excellent preservation of samples and consistent atomic C:N measurements suggest that samples were sufficiently well preserved, and the results are reliable.

Table 7.1. Mean preservation values, by site.

Site		%N	%C	Atomic C:N
Yuraq Qaqa	(N = 31)	12.46	33.90	3.18
Sahuara	(N = 15)	13.49	36.62	3.17



Table 7.2. Stable carbon and nitrogen isotope data from the Colca Valley, Peru (N = 46).

Laboratory Code	Specimen Code	Age	Sex	Modification Category	%N	%C	Atomic C:N	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$
<i>Yuraq Qaqa (CO-098)</i>									
VBIRL-355	1025.0104	MA	F	Oblique	15.13	40.70	3.14	-13.10	13.24
VBIRL-356	1025.0110	YA/MA	F	Unmodified	14.98	40.61	3.16	-15.44	14.13
VBIRL-342	1028.0082	MA	M	Unmodified	12.44	33.63	3.15	-13.41	13.80
VBIRL-347	1031.0049	YA/MA	F	Unmodified	13.55	36.64	3.15	-13.89	13.06
VBIRL-357	1033.0010	MA	M	Unmodified	11.55	31.18	3.15	-12.71	14.01
VBIRL-316	1050.0002	MA/OA	F	Unmodified	13.78	37.40	3.17	-14.05	12.79
VBIRL-317	1050.0005	MA	F	Erect	13.71	37.21	3.17	-13.34	11.56
VBIRL-318	1051.0002	YA	F	Oblique	13.86	37.63	3.17	-14.10	11.88
VBIRL-319	1051.0007	YA	M	Erect	14.45	39.12	3.16	-13.29	12.68
VBIRL-320	1051.0009	YA	M	Unmodified	14.79	40.21	3.17	-12.65	13.61
VBIRL-337	1051.0009	MA	M	Unmodified	13.95	37.45	3.13	-13.30	13.83
VBIRL-321	1051.0015	MA	M	Oblique	12.38	33.60	3.17	-18.96	12.74
VBIRL-359	1058.0135	MA	M	Unmodified	13.46	36.65	3.18	-13.39	13.09
VBIRL-348	1058.0138	OA	F	Oblique	10.68	29.20	3.19	-16.49	12.32
VBIRL-360	1058.0139	MA	F	Unmodified	14.00	37.75	3.15	-15.08	12.44
VBIRL-309	1080.0286	MA	F	Slight	11.39	31.05	3.18	-13.21	12.79
VBIRL-310	1080.0299	MA	M	Oblique	8.76	24.08	3.21	-14.63	13.01
VBIRL-338	1080.0302	MA	F	Unmodified	15.55	41.70	3.13	-15.81	13.32
VBIRL-311	1080.0306	YA	F	Unmodified	10.43	29.01	3.24	-13.92	13.10
VBIRL-339	1081.0890	YA	F	Oblique	15.14	41.43	3.19	-13.15	13.27
VBIRL-361	1081.0891	MA/OA	M	Erect	13.30	35.84	3.14	-14.25	12.89
VBIRL-312	1081.0895	MA	M	Oblique	11.01	30.19	3.20	-12.38	13.19
VBIRL-313	1081.0903	MA/OA	M	Unmodified	10.91	30.60	3.27	-14.17	13.88
VBIRL-340	1081.0918	MA	M	Oblique	12.16	32.95	3.16	-14.44	13.49
VBIRL-291	1081.0923	MA	F	Erect	14.07	38.56	3.20	-13.81	12.88
VBIRL-293	1081.0927	MA/OA	F	Oblique	11.19	30.79	3.21	-16.26	12.09
VBIRL-292	1081.0927	MA/OA	M	Slight	8.25	22.41	3.17	-12.84	13.36
VBIRL-341	1081.0928	OA	F	Oblique	13.78	37.42	3.17	-15.99	11.08

Laboratory Code	Specimen Code	Age	Sex	Modification Category	%N	%C	Atomic C:N	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$
VBIRL-294	1081.0934	MA	M	Oblique	11.35	31.19	3.21	-11.91	12.94
VBIRL-295	1081.0936	YA	F	Oblique	8.15	22.20	3.18	-13.14	11.55
VBIRL-314	1081.0940	OA	M	Unmodified	8.01	22.37	3.26	-15.04	12.93
<i>Sahuara (CO-118)</i>									
VBIRL-343	2000.0071	MA	F	Erect	13.50	36.71	3.17	-14.76	12.51
VBIRL-344	2000.0072	YA/MA	M	Unmodified	12.58	34.31	3.18	-15.17	13.68
VBIRL-345	2000.0073	OA	F	Unmodified	14.49	39.16	3.15	-16.33	12.58
VBIRL-346	2000.0076	YA/MA	M	Erect	14.20	38.41	3.16	-12.76	12.94
VBIRL-349	2000.0079	MA	M	Erect	14.52	39.53	3.18	-12.89	13.71
VBIRL-350	2000.0089	MA	M	Oblique	14.83	40.44	3.18	-13.83	13.85
VBIRL-351	2002.0280	MA	M	Unmodified	7.60	21.07	3.23	-14.98	13.34
VBIRL-352	2005.0001	MA	F	Erect	13.99	37.78	3.15	-14.57	13.00
VBIRL-353	2007.0050	YA/MA	M	Unmodified	12.78	34.83	3.18	-12.66	12.81
VBIRL-354	2009.0165	MA	F	Unmodified	14.77	39.72	3.14	-16.74	13.02
VBIRL-362	2009.0166	YA	F	Unmodified	13.31	36.51	3.20	-14.98	13.25
VBIRL-363	2009.0175	MA	F	Unmodified	15.48	41.73	3.15	-14.07	13.61
VBIRL-364	2011.0458	YA	F	Oblique	14.32	38.88	3.17	-15.18	13.41
VBIRL-365	2011.0468	YA	M	Unmodified	14.13	38.40	3.17	-13.26	13.85
VBIRL-366	2011.0470	MA	F	Slight	11.77	31.91	3.16	-14.64	12.70

Table 7.3. Mean and standard deviation of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values, by mortuary context.

Mortuary Context	N	$\delta^{13}\text{C}$		$\delta^{15}\text{N}$	
		Mean	s.d.	Mean	s.d.
Yuraq Qaqa					
003	7	-14.24	2.14	12.73	0.82
027	2	-14.27	1.66	13.69	0.63
028	1	-13.41		13.80	
035	16	-14.06	1.28	12.86	0.72
051	2	-13.30	0.83	13.54	0.67
054	3	-14.99	1.55	12.62	0.41
<i>Subtotal</i>	31	-14.13	1.47	12.94	0.74
Sahuara					
<i>Subtotal</i>	15	-14.45	1.22	13.22	0.46
Total	46	-14.24	1.39	13.03	0.67

#### *Overall Diet*

Mean and standard deviation of stable carbon and nitrogen isotope ratios for the pooled sample and each mortuary context are listed in (Table 7.3). The mean  $\delta^{13}\text{C}$  value for all 46 Colca Valley samples is  $-14.24 \pm 1.39\text{‰}$ . These data suggest a significant carbon-enriched diet, but not nearly at the levels observed for pre-contact cultural groups in the Americas known to have intensively cultivated and consumed maize (Finucane 2009; White, et al. 1993). A relatively high standard deviation around the mean  $\delta^{13}\text{C}$  suggests considerable intra-population variability in the consumption of carbon-enriched foods, such as maize.

The mean  $\delta^{15}\text{N}$  value is  $13.03 \pm 0.67\text{‰}$ . Nitrogen values are especially high for a highland population, which is not expected to have consumed marine resources in any significant amount. They slightly exceed the average value reported for Yara (11.85  $\pm$  1.99‰), where animal meat (llamas and alpacas) made up the bulk of dietary protein (Lozada, et al. 2009; Tomczak 2003; see Figure 7.1). Given the ecological setting and ethnohistoric evidence of intensive pastoralism in the upper Colca Valley, I will argue that uniformly high  $\delta^{15}\text{N}$  indicates a diet rich in terrestrial protein, most likely camelid meat. Nitrogen values of plant resources may

have also been enriched by the use of camelid dung fertilizer, which in turn would elevate average nitrogen values each subsequent step up the food chain (Szpak, et al. 2012). A small standard deviation around mean  $\delta^{15}\text{N}$  suggests that most individuals consumed similar trophic level foods.

In gross perspective, nearly all individuals sampled shared this overall dietary profile involving maize and terrestrial protein consumption, regardless of burial location or biocultural identity, suggesting that most people probably ate the same foods, but in varying proportions. However, small but significant intra-population differences are revealed when the data are partitioned by age, sex, and the presence or absence of CVM. These patterns are explored in detail below.

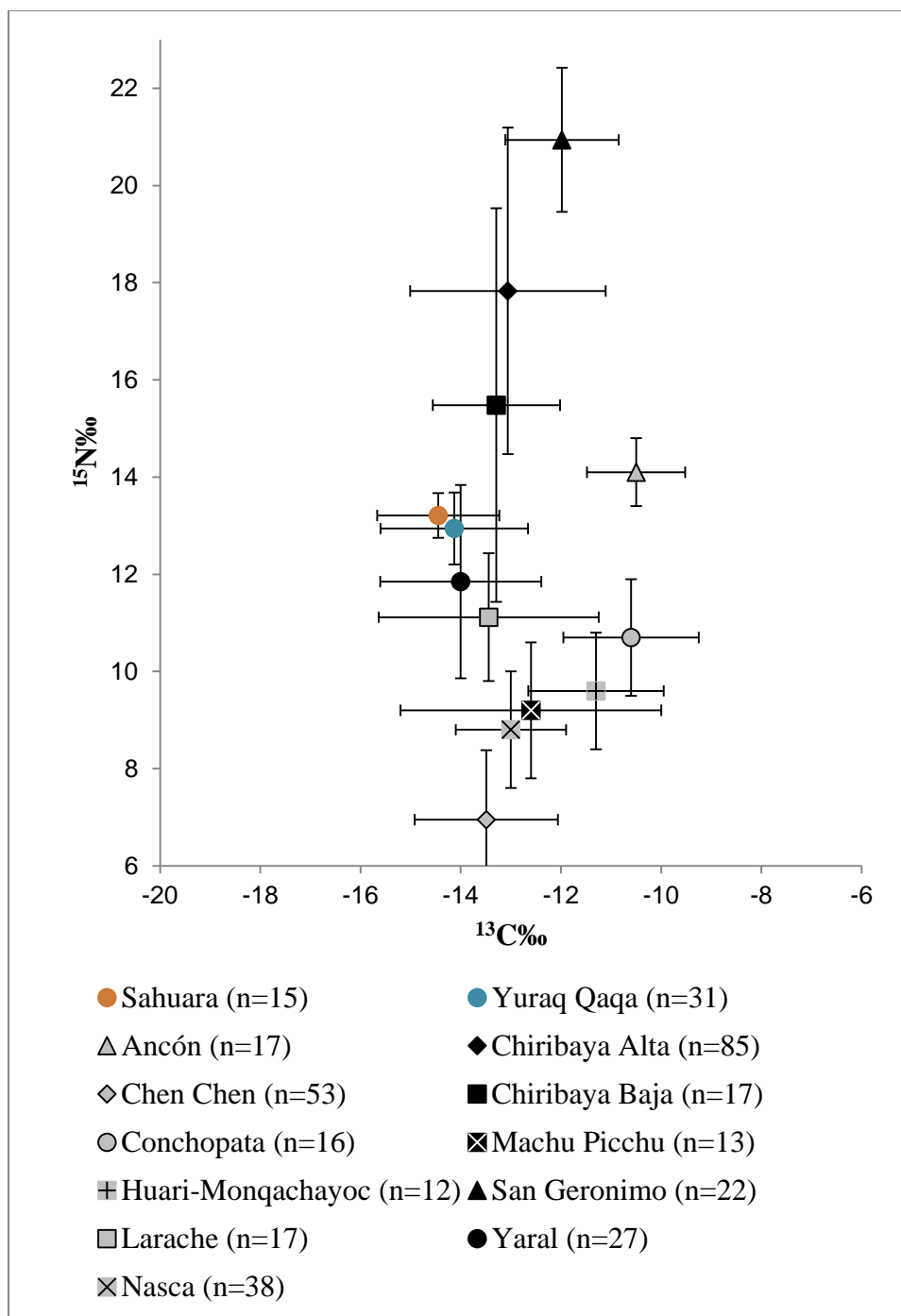


Figure 7.1. Mean  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  from bone collagen for the Colca Valley sites, compared with published data from other prehispanic sites in the Andes (whiskers are  $\pm 1$  s.d.). Gray markers = Middle Horizon. Black markers = LIP/LH.<sup>80</sup>

<sup>80</sup> Non-infant bone collagen data from; Burger et al. 2003; Finucane et al. 2006; Finucane 2009; Kellner and Schoeninger 2008; Slovak and Paytan 2009; Tomczak 2001; Tomczak 2003; Torres-Rouff et al. 2015.

## Age Differences

Although breast feeding and weaning practices can affect stable carbon and nitrogen values in nursing infants (Katzenberg, et al. 1996; Richards, et al. 2002), the present study circumvents this issue of age-related variation by only sampling adult bone collagen. Nevertheless, differences between adult age groups were analyzed to assess the possibility that age-related status or care for the elderly mediated access to dietary resources. Crania were assigned an ordinal code (1-5) based on increasing age, and correlations with  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  were calculated using Spearman's rank correlation coefficient. There is a statistically significant moderate correlation between age and  $\delta^{13}\text{C}$ , with values slightly but detectably decreasing with increasing age (Spearman's rho = -0.314, p = 0.033; Table 7.4).<sup>81</sup> This result suggests that consumption of C4-enriched foods may have been curtailed in older age.

There is also a negative correlation between age and  $\delta^{15}\text{N}$ , but it is not statistically significant (Spearman's rho = -0.153, p = 0.313). Among females only, the negative relationship between age and  $\delta^{15}\text{N}$  is moderate and statistically significant (Spearman's rho = -0.418, p = 0.042, N = 24).

Table 7.4. Mean and standard deviation of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values, by age category.

Age Category	N	$\delta^{13}\text{C}$		$\delta^{15}\text{N}$	
		Mean	s.d.	Mean	s.d.
YA	10	-13.77	0.83	12.94	0.73
YA/MA	5	-13.98	1.30	13.33	0.56
MA	23	-14.17	1.53	13.13	0.56
MA/OA	4	-14.38	1.41	13.06	0.76
OA	5	-15.96	0.65	12.23	0.80

<sup>81</sup> Among males only, there is a negative trend in  $\delta^{13}\text{C}$  with increasing age but it does not reach significance (-0.328, p = 0.137, N = 22). For females, the age correlation is nearly statistically significant at the 0.01 level (-0.481, p = 0.017). Because partitioning the sample into five age groups results in small group sizes, especially for the YA/MA, MA/OA, and OA categories, the overall and sex-specific age by  $\delta^{13}\text{C}$  associations were also explored using a 3-point ordinal variable, and the results were consistent. Dividing the sample into three or five age groups does not significantly change overall patterns.

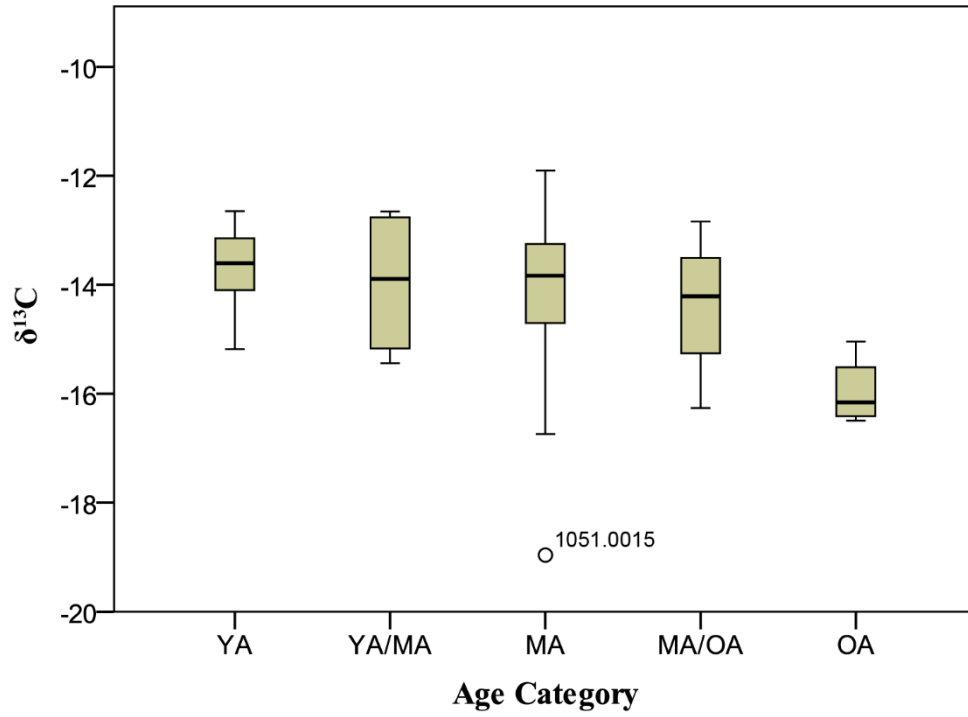


Figure 7.2. Box-and-whisker plot of  $\delta^{13}\text{C}$  values within ascending age categories.

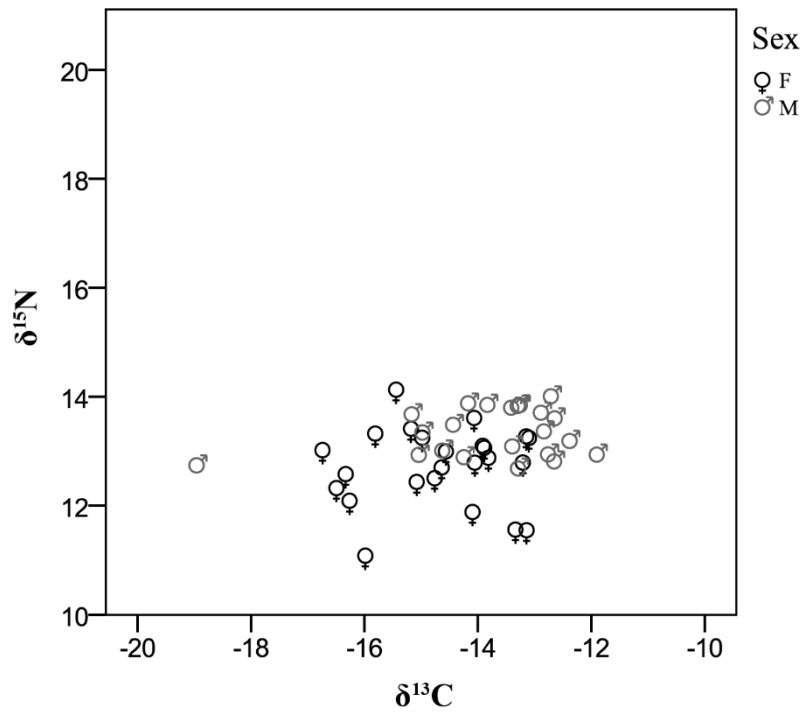


Figure 7.3. Bivariate plot of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values, by sex.

### *Sex Differences*

Mean  $\delta^{13}\text{C}$  is nearly 1‰ higher on average for males ( $-13.77 \pm 1.48\text{‰}$ ) than females ( $-14.69 \pm 1.24\text{‰}$ ), a difference that is highly statistically significant (Mann-Whitney U,  $z = -2.683$ ,  $p = 0.007$ ). The male average value is even more pronounced if the only  $\delta^{13}\text{C}$  statistical outlier ( $-18.96\text{‰}$ ), a possibly non-local male, is excluded from calculations ( $-13.52 \pm 0.95\text{‰}$ ). Finally, among those individuals with  $\delta^{13}\text{C} > -13.00\text{‰}$ , all eight of them are male, further underscoring this sex-based difference in  $\delta^{13}\text{C}$  (Figure 7.3).

There is also a slight but statistically significant difference between males and females in  $\delta^{15}\text{N}$  values. Males average  $13.35 \pm 0.44\text{‰}$  compared to  $12.73 \pm 0.71\text{‰}$  for females. The mean difference is statistically significant ( $z = -2.991$ ,  $p = 0.003$ ). There are several possible explanations for the observed effect, none of which are mutually exclusive. First, it is important to note that on average the difference between males and females is smaller than the expected trophic level shift of approximately 3‰ (Deniro and Epstein 1981; Schoeninger and DeNiro 1984). Thus, the observed difference may be one of degree, with males eating a slightly greater proportion of  $^{15}\text{N}$ -enriched foods, such as animal meat. In addition, women eating less maize could have the effect of reducing their nitrogen isotope values overall, if maize was enriched in  $^{15}\text{N}$  due to a manuring effect (Szpak et al. 2012). However, if maize consumption were the sole variable, we would expect  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  to be positively correlated across the entire sample. While there is a positive correlation coefficient, it is not statistically significant ( $r = 0.237$ ,  $p = 0.113$ ,  $N = 46$ ). Other factors influencing male-female dietary variation will be explored in the following sections.

Because of multiple statistically significant relationships between stable isotope values and age and sex, it is necessary to explore how these factors differentially (or interactionally)



account for the observed variation in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ . Note that all age categories are represented among males or females, and so the results are not due to skewed sampling.<sup>82</sup> To explore the differential effects of sex and age, multiple linear regressions were calculated with  $\delta^{13}\text{C}$  as the dependent variable, and binary sex (0, 1) and age (coded as k-1 dummy variables) as independent variables. Sex is a statistically significant predictor of  $\delta^{13}\text{C}$ , accounting for 10.7% of the variance in  $\delta^{13}\text{C}$  ( $p = 0.026$ ). After controlling for sex, age more than doubles the proportion of variance explained ( $R^2 = 0.259$ ,  $R^2$  Change = 0.152), but the increase is not statistically significant ( $p = 0.106$ ).

Using the General Linear Model function in SPSS, two-way analysis of variance (ANOVA) was also conducted to assess whether there is an interaction effect between age and sex. Both sex ( $F = 8.979$ ,  $p = 0.005$ ) and age ( $F = 3.326$ ,  $p = 0.046$ ) have a main effect on  $\delta^{13}\text{C}$ , when 3-point ordinal age is used as a fixed factor (GLM1). However, when 5-point ordinal age is used as a fixed factor, the F-test fails to reject the null hypothesis that there is no effect of age on  $\delta^{13}\text{C}$  ( $F = 1.736$ ,  $p = 0.163$ ). This is probably due to the small sample sizes in each constituent age category, when divided by sex. In either model, there is no interaction effect between sex and age (GLM1;  $F = 1.260$ ,  $p = 0.295$ ), suggesting that the sex effect is the same across all age levels.

In sum, skeletal sex, as a proxy for gender, appears to have a more significant and wide-ranging effect on stable isotope values than does one's age-related identity. Given the results of the first general linear model, it is possible that age does indeed have a small effect— independent of sex—but a larger sample size will be required to confirm this hypothesis. As will

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<sup>82</sup> Age category (YA, YA/MA, MA, MA/OA, OA) and sex (M, F) are statistically independent ( $\chi^2 = 2.361$ ,  $df = 4$ , Exact Sig., 2-sided = 0.731) in the sample subjected to isotope analysis ( $N = 46$ ).

be shown, the dietary differences between the sexes are not uniform over time or across subgroups based on cranial modification.

### *CVM and Diet*

Stable isotope values of individuals with and without CVM were compared to evaluate if this salient marker of social identity influenced adult diet, either as an index of subsistence specialization or preferential status. The average  $\delta^{13}\text{C}$  values for unmodified ( $-14.34 \pm 1.19\%$ ,  $N = 21$ ) and modified individuals ( $-14.16 \pm 1.55\%$ ,  $N = 25$ ) do not differ statistically ( $z = -0.871$ ,  $p = 0.384$ ), although the latter group exhibits a higher standard deviation. This is because the aforementioned  $\delta^{13}\text{C}$  statistical outlier is a modified individual.<sup>83</sup> Overall, these results indicate that the presence or absence of CVM does not entail a qualitative difference in the consumption of carbon-enriched foods during adulthood. Maize was probably a substantial component of the diet of nearly all individuals, regardless of modification status.

Although nitrogen values exhibit less variability than carbon values overall, the central tendency and dispersion around the mean differ according to whether or not an individual exhibits CVM. Mean  $\delta^{15}\text{N}$  for unmodified individuals is  $13.34 \pm 0.49\%$  ( $N = 21$ ). In contrast, mean  $\delta^{15}\text{N}$  is significantly lower for modified individuals ( $12.76 \pm 0.69\%$ ,  $N = 25$ ). Although small, the mean difference is highly statistically significant ( $z = -2.812$ ,  $p = 0.005$ ). The scatterplot of isotope values coded by CVM presence also illustrates the difference in variability, with modified individuals exhibiting greater inter-individual spacing along the y-axis, compared to unmodified individuals who are relatively tightly clustered (Figure 7.4).

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<sup>83</sup> If this individual is excluded from statistical analysis, standard deviation for the modification subsample is 1.21, which is virtually the same as that for unmodified individuals (s.d. = 1.19). Although excluding the outlier increases mean  $\delta^{13}\text{C}$  of modified individuals to  $-13.96\%$ , the mean difference between modified and unmodified groups remains statistically insignificant ( $z = -1.138$ ,  $p = 0.255$ ).

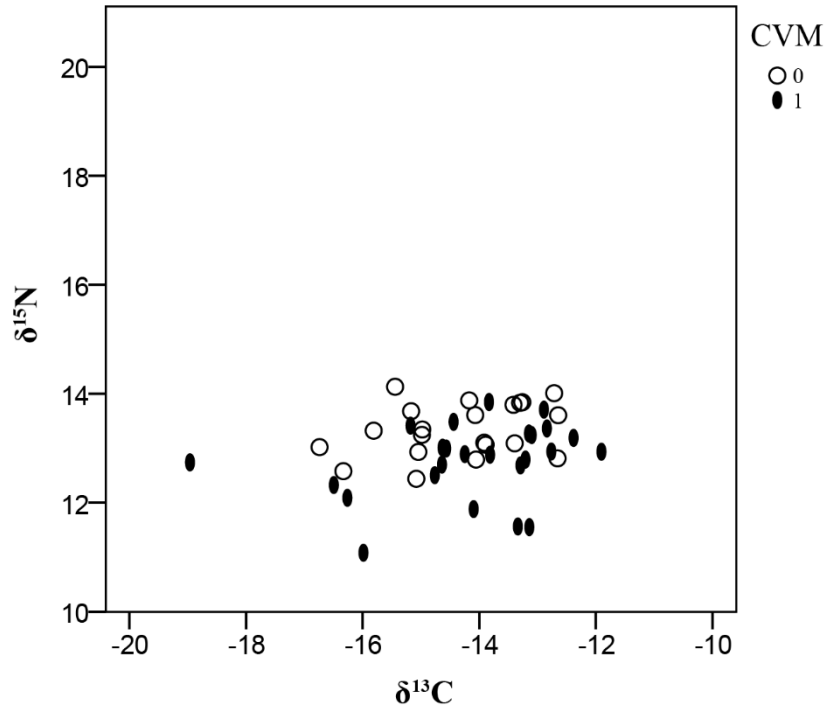


Figure 7.4.  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values for modified (1) vs. unmodified (0) individuals.

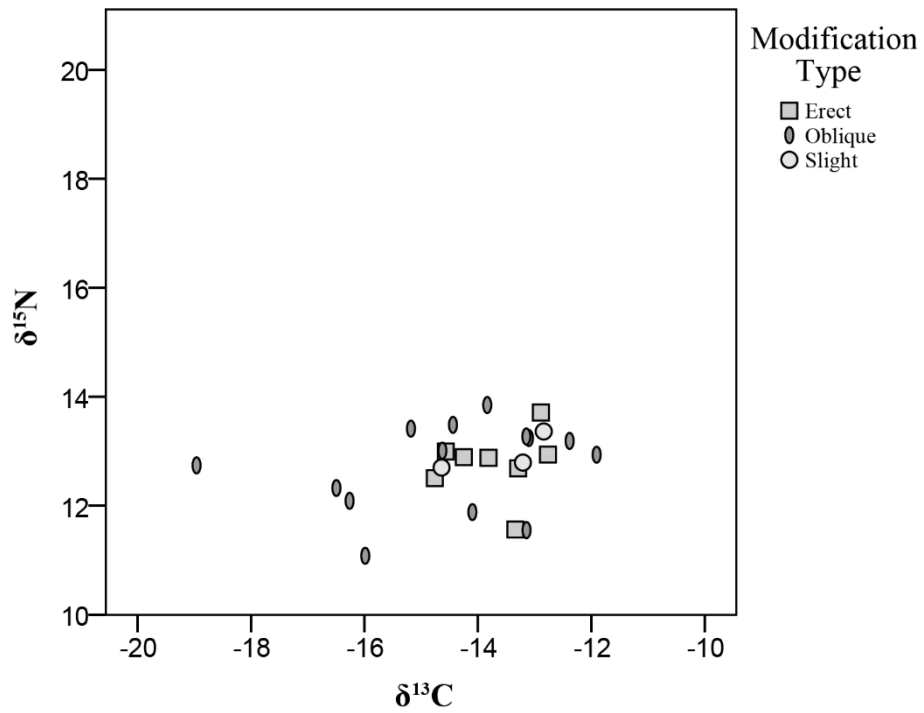


Figure 7.5.  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values for modified individuals only, coded by modification type.

The relationship between CVM and diet was also explored across modification types and variants (Figure 7.5, Table 7.5). Dividing the sample into modification variants results in very small sample sizes, but the descriptive results are nonetheless suggestive and merit further exploration with larger samples. Individuals with oblique modification have lower  $\delta^{13}\text{C}$  values ( $-14.54 \pm 1.90\%$ ,  $N = 14$ ) than those with erect modification ( $-13.71 \pm 0.76\%$ ,  $N = 8$ ). Only three individuals exhibiting slight modification were sampled, and all fall within the narrower range of the erect types.

Table 7.5. Mean and standard deviation of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values, by modification type and variant.

Modification Category	N	$\delta^{13}\text{C}$		$\delta^{15}\text{N}$	
		Mean	s.d.	Mean	s.d.
<b>Erect</b>					
Tabular	2	-12.83	0.09	12.73	0.82
Lambdic	3	-14.21	0.80	13.69	0.63
Intermediate	2	-13.79	0.64	13.80	
Unique Erect	1	-13.81		12.86	0.72
<i>Subtotal</i>	8	-13.71	0.76	13.54	0.67
<i>Subtotal<sup>a</sup></i>	6	-13.68	0.85	12.62	0.41
<b>Oblique</b>					
Flat	4	-14.36	1.45	12.33	1.19
Rounded	8	-14.34	1.52	12.85	0.69
Unique Oblique	2	-15.67	4.65	12.96	0.32
<i>Subtotal</i>	14	-14.54	1.90	12.72	0.81
<i>Subtotal<sup>b</sup></i>	16	-14.45	1.80	12.66	0.81
<b>Slight</b>					
<i>Subtotal</i>	3	-13.56	0.95	12.95	0.36
<b>Total</b>					
Modified	25	-14.16	1.55	12.76	0.69
Unmodified	21	-14.34	1.19	13.34	0.49

<sup>a</sup> Erect subtotal excluding erect intermediate forms

<sup>b</sup> Oblique subtotal including erect intermediate forms

Exploring more deeply the differences within CVM types, individuals with tabular erect modification ( $N = 2$ ) exhibit relatively high stable carbon ( $-12.83 \pm 0.09\%$ ) and nitrogen (13.32

$\pm 0.54\text{‰}$ ) values, which suggest greater-than-average consumption of maize and a high protein diet. This recalls the ethnohistoric association of the tabular erect type with the lower-lying Cabanas region, where maize was more intensively cultivated (Pease G.Y. 1977b). Yet neither individual exhibiting this style falls outside of the “local” range, and so dietary differences between CVM sub-categories, if they existed, would have been of degree, not of kind.<sup>84</sup>

At the other extreme, the lowest  $\delta^{13}\text{C}$  value ( $-18.96\text{‰}$ ), a statistical outlier, represents a male individual (1051.0015) with a unique form of cranial modification (Figure 7.6 and Figure 7.7). His  $\delta^{13}\text{C}$  value is more than three standard deviations below the sample mean. Although his head shape could be broadly categorized as oblique, the modification technique involved two distinct centers of compression (at lambda and the occipital squama) and resulted in marked bilateral expansion. A focal depression on the occipital squama, rare among modified crania, is also observed superior to inion. In short, the individual provides evidence of a “unique” modification style that was probably not autochthonous to the valley; accordingly, he may have been an outsider who lived his adult life in a region where maize (or other carbon-enriched resources) was less abundant.

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<sup>84</sup> Moreover, both individuals with tabular erect modification are male, and gender identity may have been a more salient characteristic explaining their elevated  $\delta^{13}\text{C}$  values.



Figure 7.6.  $\delta^{13}\text{C}$  outlier (1051.0015) with unique variant of oblique modification (“oblique unique”).

With respect to  $\delta^{15}\text{N}$ , the lowest mean values are exhibited by individuals with the “intermediate” cranial vault form, followed by the oblique flat variant—both of which were produced by a similar technique involving antero-posterior compression with circular binding.<sup>85</sup> In general, oblique variants are driving the statistically significant difference in  $\delta^{15}\text{N}$  between modified and unmodified individuals. Of the six modified individuals with values  $<12.5\%$ , five have oblique style crania and one exhibits the intermediate form. All are female, which suggests

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<sup>85</sup> Recall from Chapter 5 that the erect intermediate variant shares many technical similarities with oblique modification; their primary difference being the angle of modification. The dietary data further suggest that intermediate and oblique forms index a similar social identity.

that the statistically significant difference in  $\delta^{15}\text{N}$  between modified and unmodified individuals may not be wholly independent from the sex-based difference outlined earlier.

To formally test for an interaction effect between sex and CVM, a univariate general linear model (GLM) was conducted, using  $\delta^{15}\text{N}$  as the dependent variable and binary sex (0,1) and CVM presence (0,1) as fixed factors. The GLM reaffirms that both sex ( $F = 12.002$ ,  $p = 0.001$ ) and CVM presence ( $F = 10.605$ ,  $p = 0.002$ ) have strong main effects on  $\delta^{15}\text{N}$  values. Together, they account for 38.7% (Adjusted  $R^2 = 0.343$ ) of the variance in  $\delta^{15}\text{N}$ . However, the two-way ANOVA fails to reject the null hypothesis for a sex by CVM interaction effect ( $F = 0.957$ ,  $p = 0.333$ ). Both males and females exhibiting cranial modification, on average, have slightly lower nitrogen values than their unmodified counterparts, although the effect appears to be slightly greater for females (Mean diff. = 0.68‰ versus 0.37‰). In fact, considering only males, the Mann-Whitney U test between modified and unmodified crania is not quite statistically significant at the 0.05 level ( $Z = -1.806$ ,  $p = 0.071$ ; Table 7.6).

In sum, females with modified heads ( $N = 14$ ) exhibit the lowest nitrogen values on average, but also the greatest range in  $\delta^{13}\text{C}$  (3.39‰) and  $\delta^{15}\text{N}$  (2.33‰), when the sample is divided into subgroups by sex and cranial vault modification and outliers are excluded (Figure 7.7 and Figure 7.8). Both descriptive statistics (standard deviation) and visual assessment (inter-individual spacing in a bivariate plot) affirm these two key patterns (Figure 7.9).

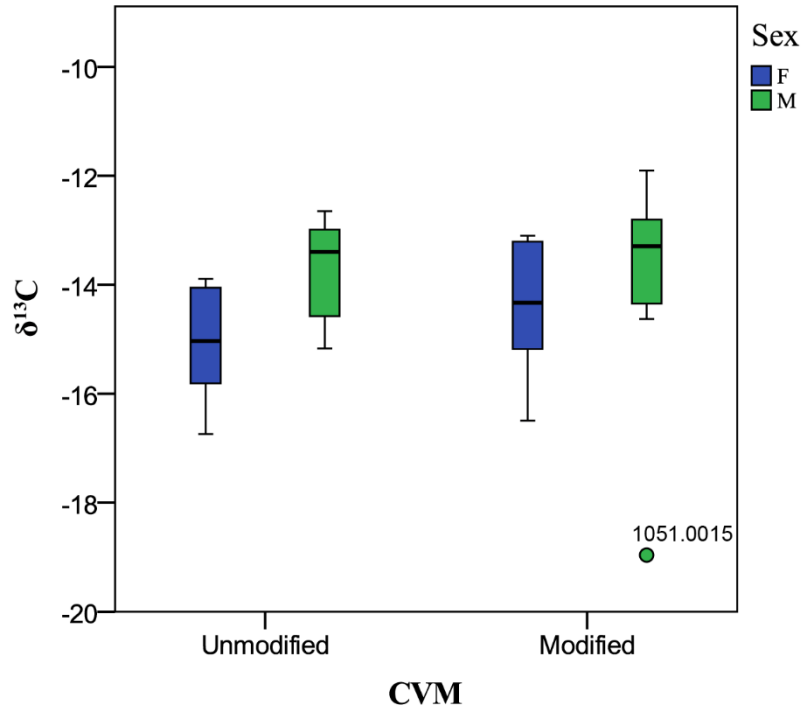


Figure 7.7. Box plot of  $\delta^{13}\text{C}$  values by CVM and sex.

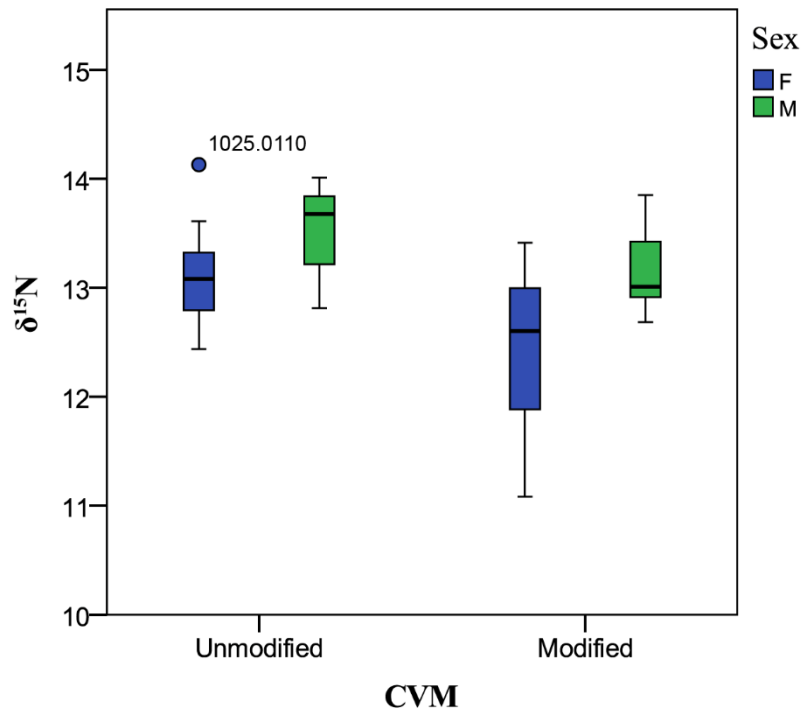


Figure 7.8. Box plot of  $\delta^{15}\text{N}$  values by CVM and sex.



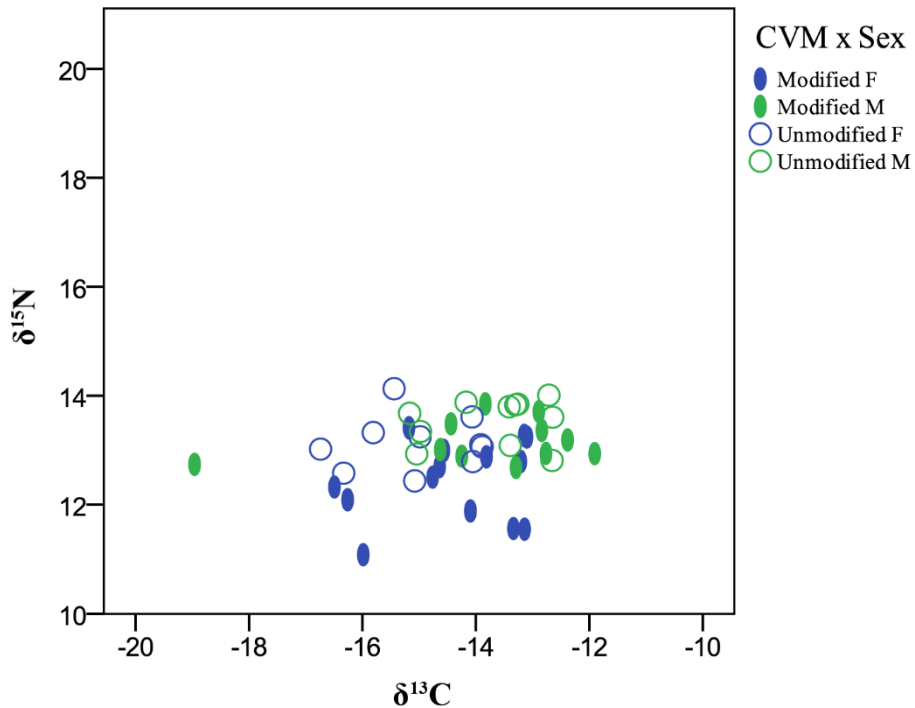


Figure 7.9.  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values, by CVM and sex.

### *Temporal Differences*

Given the dramatic social changes that were occurring in the Colca Valley across the Late Intermediate Period, temporal shifts in diet (and by extension, subsistence practice) were assessed through stable isotope analysis. Individuals from Early LIP contexts at Sahuara and Yuraq Qaqa exhibit average  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values of  $-14.37 \pm 1.24\text{‰}$  and  $13.19 \pm 1.24\text{‰}$ , respectively. Isotope values for individuals from Late LIP contexts, which were all located at Yuraq Qaqa, are slightly higher for  $\delta^{13}\text{C}$  ( $-14.13 \pm 1.51\text{‰}$ ) and lower for  $\delta^{15}\text{N}$  ( $12.89 \pm 0.75\text{‰}$ ), but the differences are not statistically significant (Table 7.6). Overall, this initial comparison suggests that subsistence practices in the upper Colca Valley were relatively stable throughout the Late Intermediate Period (A.D. 1100-1450).

However, the dietary differences between temporal groups based on sex and CVM are not consistent across time. Sex-based differences in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  are more pronounced in the Early LIP (Figure 7.10, top panel). Mean  $\delta^{13}\text{C}$  for Early LIP males (N = 10) is  $-13.51 \pm 0.906\text{‰}$ , over 1.5‰ higher on average than the values for females ( $-15.16 \pm 0.963\text{‰}$ , N = 11). Despite small sample sizes, the differences between males and females are clearly illustrated in the scatterplot and are highly statistically significant ( $z = -3.028$ ,  $p = 0.002$ ; Table 7.6). Differences in  $\delta^{15}\text{N}$  are of a smaller magnitude, but also statistically significant at the 0.01 level ( $z = -2.676$ ,  $p = 0.007$ ). On average, female  $\delta^{15}\text{N}$  values are 0.6‰ lower than male  $\delta^{15}\text{N}$  values ( $12.90 \pm 0.422\text{‰}$  vs.  $13.51 \pm 0.427\text{‰}$ ). Notably, there are no dietary outliers in the Early LIP and standard deviations for males and females, for both dietary isotopes, are broadly similar.

The pattern in the Late LIP is observably different, as shown in the bottom panel of Figure 7.10. First, the marked difference between males and females in  $\delta^{13}\text{C}$  does not persist in the Late LIP. Mean female  $\delta^{13}\text{C}$  values ( $-14.26 \pm 1.189\text{‰}$ , N = 13) are marginally lower than male  $\delta^{13}\text{C}$  values ( $-13.99 \pm 1.848\text{‰}$ , N = 12), but the difference is not statistically significant ( $z = -0.653$ ,  $p = 0.538$ ). With respect to  $\delta^{15}\text{N}$  values, the mean difference between males ( $13.21 \pm 0.413\text{‰}$ , n = 12) and females ( $12.59 \pm 0.884\text{‰}$ , n = 13) remains similar through time ( $\sim 0.6\text{‰}$ ), but it is no longer statistically significant ( $z = -1.795$ ,  $p = 0.073$ ).<sup>86</sup> Incidentally, the highest  $\delta^{15}\text{N}$  value comes from a female (14.13‰), which shows that the tendency for a sex-based distinction in the consumption of nitrogen-enriched foods was hardly absolute (Figure 7.8). Regardless, females from Late LIP contexts exhibit greater heterogeneity of nitrogen isotope values relative to males; standard deviation for females is nearly twice the size of the male standard deviation. Conversely, male stable isotope values throughout time cluster tightly on a bivariate plot.

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<sup>86</sup> If the male outlier (1051.0015) is excluded, the  $\delta^{15}\text{N}$  difference is statistically significant at the 0.05 level ( $z = -1.999$ ,  $p = 0.046$ ). The  $\delta^{13}\text{C}$  values for males and females remain statistically similar ( $z = -1.072$ ,  $p = 0.284$ ).

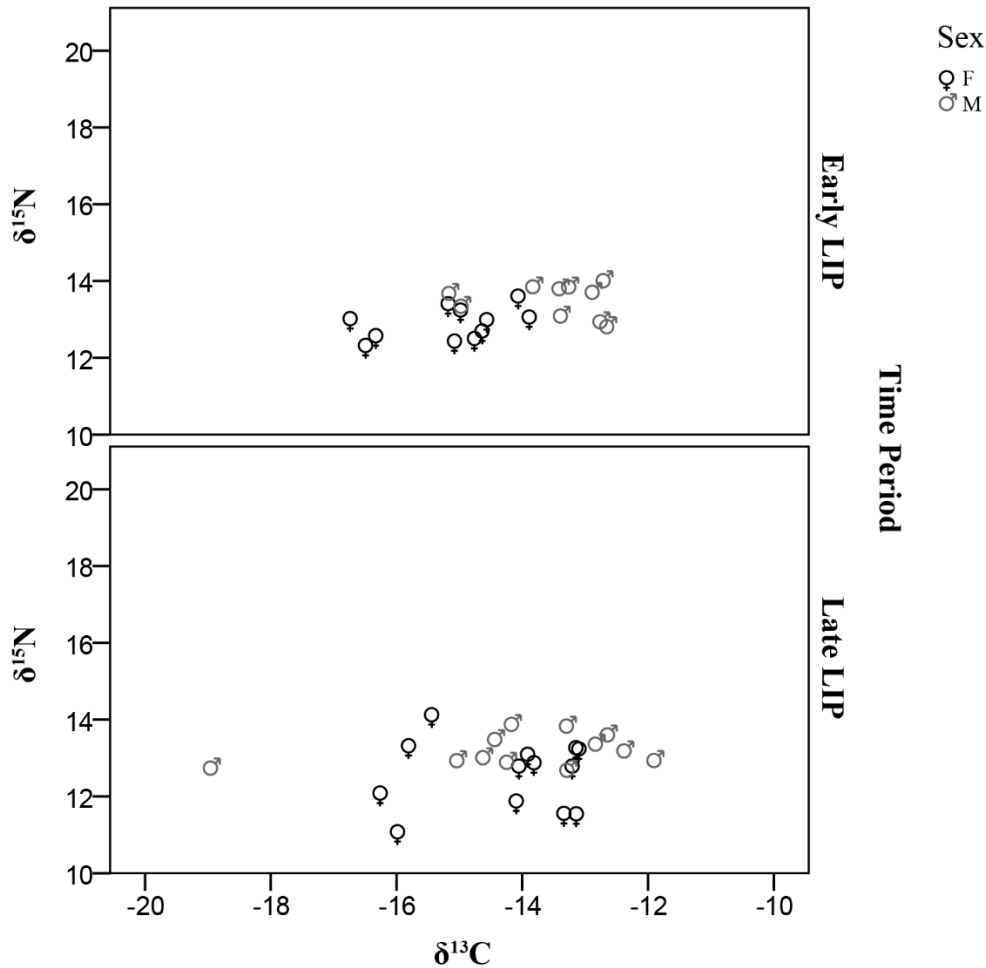


Figure 7.10.  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values for males and females, by time period.

Finally, when the sample is partitioned temporally, the difference in  $\delta^{15}\text{N}$  between modified and unmodified individuals remains statistically significant for the Late LIP sample ( $z = -2.563$ ,  $p = 0.010$ ,  $N = 25$ ), but negligible for the Early LIP sample ( $z = -0.941$ ,  $p = 0.346$ ,  $n = 21$ ). This is not surprising since oblique modification, which drives the CVM effect on  $\delta^{15}\text{N}$ , surges in frequency during the Late LIP.<sup>87</sup> In this later period, the average difference between modified ( $12.62 \pm 0.721\text{‰}$ ) and unmodified ( $13.45 \pm 0.486\text{‰}$ )  $\delta^{15}\text{N}$  values is  $0.8\text{‰}$ , whereas it

<sup>87</sup> There are only 8 modified individuals for the Early LIP and only three exhibit oblique modification.

was only 0.2‰ in the Early LIP. Greater standard deviation among Late LIP modified individuals occurs in tandem with increased heterogeneity among females, since it is *modified* females that extend the lower limit of nitrogen values from 12.32‰ during the Early LIP to 11.08‰ during the Late LIP. Clearly, a nuanced interpretation of diachronic dietary changes will need to account for two interrelated findings: 1) small, but significant sex-based differences, and 2) an increase in overall dietary heterogeneity that is not reducible to either modification status or gender.

### *Inter- and Intra-Site Differences*

Mean  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  were compared between cemetery sites located on opposite sides of the Chillihuitira River, an important hydrological boundary that structured landholding and residence patterns in the late prehispanic era (Wernke 2007b; Wernke 2013). It was hypothesized that dietary differences may have accompanied these social and economic distinctions. The age and sex differences outlined above should not skew inter-site comparisons because the adult demographic distributions at Yuraq Qaqa (CO-098) and Sahuara (CO-118) are statistically similar, and the isotope sample is representative of these distributions.

Similar to the broad chronological comparison (Early LIP vs. Late LIP), there are no statistically significant differences between groups based on burial location. Average carbon values between the west and east cemeteries (Yuraq Qaqa and Sahuara, respectively) are remarkably similar ( $z = -1.043$ ,  $p = 0.297$ ; Table 7.6). Average nitrogen values are also statistically indistinguishable between cemeteries ( $z = -1.136$ ,  $p = 0.256$ ), although greater variability in  $\delta^{15}\text{N}$  among individuals at Yuraq Qaqa is indicated by a higher standard deviation from the mean (s.d. = 0.74 vs. 0.46) and larger absolute range in values (11.08 to 14.13). In fact,

minimum and maximum  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  for the entire sample are from individuals buried at Yuraq Qaqa, whereas isotopic values from Sahuara (CO-118) are more closely spaced (Figure 7.11). This result reflects the increase in dietary heterogeneity during the Late LIP, whereas Sahuara lacks a Late LIP component.

If only Early LIP samples are considered, there is still no significant inter-site difference, although the Early LIP sample for Yuraq Qaqa is especially small ( $N = 6$ ), limiting statistical power ( $z = -0.234$ ,  $p = 0.815$ ).

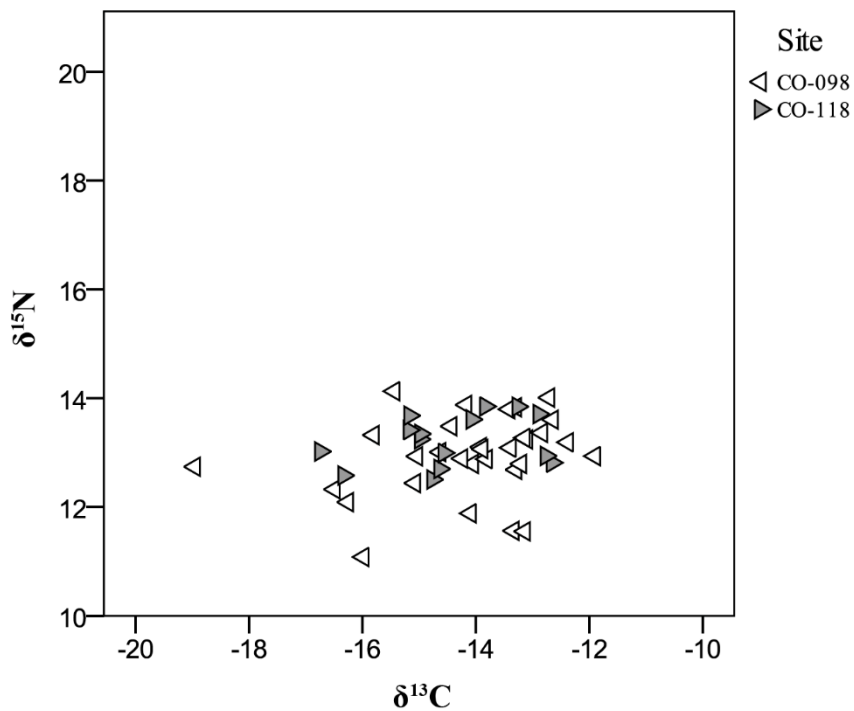


Figure 7.11.  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values, by site.

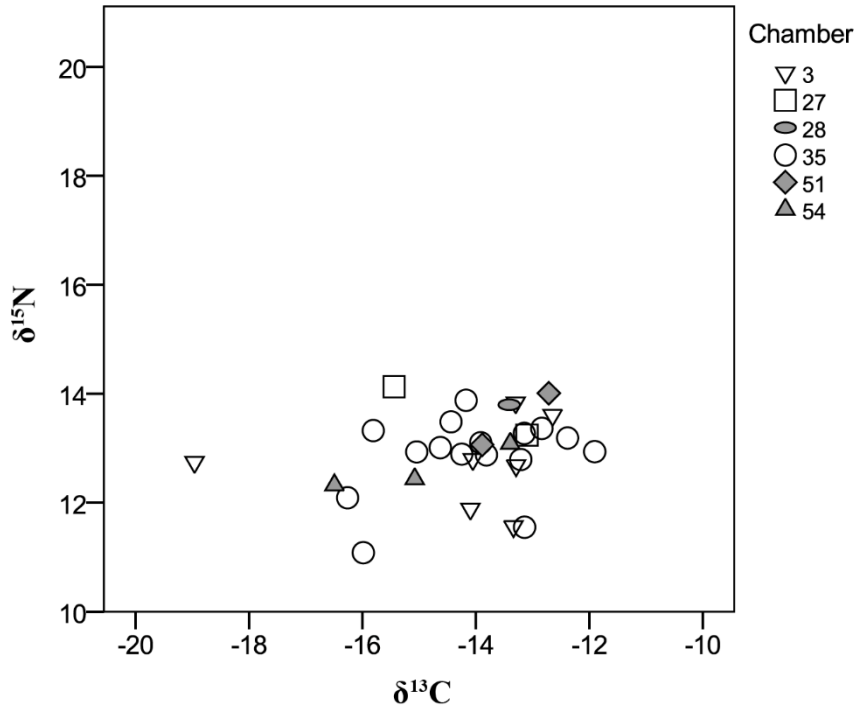


Figure 7.12.  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values for Yuraq Qaqa (CO-098), by chamber. Gray markers indicate Early LIP chambers.

The scatterplot in Figure 7.12 further illustrates how dietary variability does not segregate by burial location at the intra-site level, although 4 of the 6 burial groups at Yuraq Qaqa (CO-098) include no more than 3 individuals (Table 7.3). Comparison of means between the two burial groups with  $N \geq 7$  (Chamber 003 and Chamber 035) does not yield significant differences in  $\delta^{13}\text{C}$  ( $z = -0.267$ ,  $p = 0.789$ ) or  $\delta^{15}\text{N}$  ( $z = -0.869$ ,  $p = 0.385$ ).<sup>88</sup> In short, gender, time period, and CV differences are driving dietary variation—not burial location (as a proxy of lineage group).

<sup>88</sup> The null hypothesis is still accepted if CO-118 is included in the comparison using the Kruskal-Wallis test;  $\delta^{13}\text{C}$ : Chi-square = 1.461,  $p = 0.482$ ;  $\delta^{15}\text{N}$ : Chi-square = 3.029,  $p = 0.220$ .

Table 7.6. Summary of two-sample group comparisons (Mann-Whitney U) of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values from bone collagen.

Between-Group	$\delta^{13}\text{C}$		$\delta^{15}\text{N}$	
	z	p	z	p
Male vs. female	-2.683	<b>0.007</b>	-2.991	<b>0.003</b>
Unmodified vs. modified	-0.871	0.384	-2.812	<b>0.005</b>
Unmodified vs. modified, male	-0.361	0.718	-1.806	0.071
Unmodified vs. modified, female	-1.347	0.178	-2.166	<b>0.030</b>
Early vs. Late LIP	-0.981	0.326	-1.202	0.229
Male vs. female, early LIP	-3.028	<b>0.002</b>	-2.676	<b>0.007</b>
Male vs. female, late LIP	-0.653	0.538	-1.795	0.073
Male vs. female, late LIP (w/o outlier)	-1.072	0.284	-1.999	<b>0.046</b>
Unmodified vs. modified, early LIP	-0.072	0.942	-0.941	0.346
Unmodified vs. modified, late LIP	-0.874	0.382	-2.563	<b>0.010</b>
Yuraq Qaqa vs. Sahuara	-1.043	0.297	-1.136	0.256
Chamber 003 vs. 035 (Yuraq Qaqa)	-0.267	0.789	-0.869	0.385

All p-values are 2-tailed significance tests. Values in **bold** are statistically significant at the 0.05 level.

## Discussion

### *Diet and Economic Specialization in the Upper Colca Valley*

Ethnohistoric accounts of the Colca Valley's inhabitants tell us that the Collaguas were a predominantly pastoralist group that descended into the valley from the *puna* flatlands, where pasturage for camelid herds was abundant, while other forms of agriculture were more tenuous. Spanish colonial documents confirm that particular communities and households in the central and upper valley held enormous wealth in camelid herds and the wool they produced (Wernke 2013). There is also little doubt the Collaguas grew maize at altitudes where it was feasible—at least by Inka times, if not earlier. Based on crop declarations in the *visitas*, 59% of cultivated land in Coporaque was dedicated to maize (a C4 plant, which is enriched in  $^{13}\text{C}$ ), 39% to quinoa (a C3 plant, depleted in  $^{13}\text{C}$ ), and the remaining 2% to other C3 crops, such as potatoes (Benavides 1986; Wernke 2003: 394-399). Is this mixed subsistence strategy representative of

the Late Intermediate Period population, or mainly the product of Inka and Spanish economic reorganization? How do the isotopic data compare?

#### Moderate Carbon Values: Substantial Maize Consumption

Mean and standard deviation of stable carbon and nitrogen isotope ratios can be used to characterize dietary components and draw inferences about subsistence specialization in prehistoric communities (Tomczak 2003; Yesner, et al. 2003). Recall that stable carbon isotopes from bone collagen reflect the protein component of diet and can be used to differentiate consumers of C3 versus C4 plants, and/or animals that subsisted off those plant sources (Ambrose and Norr 1993). Using carbon values of Peruvian cultigens and accounting for a diet-collagen spacing of +5‰, we would expect the  $\delta^{13}\text{C}$  values for a pure C4 and pure C3 feeder to be approximately -21‰ and -5.3‰, respectively (Szpak, et al. 2013). Thus, the study sample's average  $\delta^{13}\text{C}$  value of  $-14.24 \pm 1.39\text{‰}$  indicates a mixed C3-C4 diet with a substantial C4 component. Maize, the main C4 plant in the highland Andes, is the most likely contributor to these moderate  $\delta^{13}\text{C}$  values and was probably supplemented to varying degrees by C3 plants such as quinoa (*Chenopodium*) and a variety of tubers, as well as terrestrial animals (see below).

The only other C4 plant regularly consumed in the Andes is *kiwicha* (*Amaranthus caudatus*), a drought-tolerant crop, which could have been cultivated on unirrigated bench terraces in the Colca Valley (Brooks et al. 1998). Amaranth exhibits substantial enrichment in both isotopic values; average  $\delta^{13}\text{C}$  (-12.6‰) is indistinguishable from maize, while average  $\delta^{15}\text{N}$  (13.7‰) exceeds all other plant comestibles in the Andes (Turner, et al. 2010). There are no indications from colonial crop declarations that *kiwicha* was a major cultigen in the valley; however, high frequencies of Chenopodiaceae pollen in soils from the Chijra agricultural terraces “may indicate either quinoa or amaranth [*kiwicha*] cultivation,” but could also derive from wild



grains or weed growth (Sanford 1986: 281).<sup>89</sup> That pollen from amaranth, a C4 plant, and quinoa, a C3 plant, cannot be conclusively differentiated from one another in this context does little to clarify the dietary components reflected in bone collagen.<sup>90</sup> Although evidence of *kiwicha* cultivation is limited, it should be considered a possible confounding factor in the interpretation of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  in this study.

Estimating the contribution of maize to the Colca Valley diet is also limited by the available data set, since  $\delta^{13}\text{C}$  values obtained from bone collagen will underrepresent maize, which is only 10% protein. This is because, as the Macronutrient Routing model explains, protein carbon is preferentially routed to collagen (Ambrose, et al. 2003). Thus, the consumption of animal protein, such as camelids with a C3 or mixed C3/C4 diet, would be disproportionately reflected in bone collagen, resulting in lower  $\delta^{13}\text{C}$  values even if maize made up a larger proportion of the whole diet.<sup>91</sup>

Acknowledging the current limitations and assuming that maize was indeed the main C4 contributor to bone collagen, it would have constituted a substantial part of the local diet, ranging from ~27% to ~58% of dietary protein.<sup>92</sup> These figures are consistent with land allocation data from the colonial *visitas*, which record maize cultivation on over 50% of declared fields. Although production and consumption rates are not directly comparable, they suggest a relatively stable agricultural subsistence base throughout the late prehispanic period, with maize

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<sup>89</sup> Notably, maize pollen is absent from the same context at Chijra (Sandor 1986).

<sup>90</sup> Small amounts of a grain identified to the *Amaranthaceae* family (Gomphrena-Alternanthera type) were found in soils from the Chilacota reservoir, but this is also considered “inconclusive evidence of intentional amaranth cultivation” (Sanford 1986: 278-279).

<sup>91</sup> Conversely, elevated  $\delta^{13}\text{C}$  values could result if *maize-foddered* camelids were a significant part of the diet. Isotopic analysis of bone apatite data will help clarify different mixing scenarios.

<sup>92</sup> These proportions are roughly estimated through linear interpolation, using the  $\delta^{13}\text{C}$  values of pure feeders and the minimum and maximum values (excluding outliers) for the Colca Valley sample.

as a moderate, if not necessarily dominant component of the diet.<sup>93</sup> At the same time, the large standard deviation of  $\delta^{13}\text{C}$  suggests substantial intra-community variation in access to and consumption of maize. This could partly reflect household inequalities in total land area and the number of fields dedicated to particular crops (see Wernke 2013). For example, individuals or families with greater investment in maize cultivation at lower elevations may have consumed more maize, on average. Alternatively, wide variation in C4 consumption could reflect a cemetery population made up of individuals with different subsistence strategies, or even regional origins. This is probably the case for Individual 1051.0015, an isotopic outlier, who exhibits a unique form of cranial modification and the lowest  $\delta^{13}\text{C}$  value in the sample ( $-18.96\text{‰}$ ), indicative of a minor C4 contribution ( $\leq 15\%$ ) to dietary protein.

#### High Nitrogen Values: Manuring Agricultural Fields?

Because isotope values from bone collagen reflect the protein component of diet, it is necessary to consider the full insights of nitrogen isotope analysis when interpreting  $\delta^{13}\text{C}$  variation. Nitrogen isotope ratios in human tissue reflect the stepwise enrichment of  $^{15}\text{N}$  as it moves up the food chain, but also vary due to a myriad of environmental and anthropogenic factors (Heaton, et al. 1986; Schoeninger, et al. 1983; Szpak, et al. 2013). High  $\delta^{15}\text{N}$  values, averaging  $13.03 \pm 0.67\text{‰}$ , strongly suggest that the Colca Valley population consumed terrestrial animals, most likely camelids.<sup>94</sup> Even still, the absolute range of  $\delta^{15}\text{N}$  values in the Colca Valley sample ( $\sim 11\text{-}14\text{‰}$ ) largely exceeds the expected range for terrestrial omnivores ( $\sim 8\text{-}11\text{‰}$ ), by

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<sup>93</sup> Average  $\delta^{13}\text{C}$  ( $-14.24 \pm 1.39\text{‰}$ ) in the Colca Valley is considerably lower than values documented in other regions of the Andes where maize was a staple crop. For example, in the Ayacucho Valley, intensive maize production before and during the Middle Horizon (A.D. 600-1000) is reflected in high  $\delta^{13}\text{C}$  values from human bone collagen ( $10.2 \pm 1.35\text{‰}$ ) (Finucane 2009: 542). Substantial maize foddering of camelids also likely contributed to elevated human values (Finucane et al. 2006).

<sup>94</sup> Faunal analysis of animal bones ( $N = 455$ ) from the Chijra excavations strongly suggest “that the primary source of animal food in the diet came from the South American Camelidae,” which make up  $\sim 85\text{-}97\%$  of the assemblage, varying only slightly by cultural level (Wheeler 1986, in Denevan 1986a). Overall, however, zooarchaeological remains from precolonial contexts in the Colca Valley are relatively few, due to the lack of excavated domestic sites.

approximately one trophic level (+3‰). What accounts for the elevated nitrogen values in this highland context?

One likely possibility is that manuring of agricultural fields enriched  $^{15}\text{N}$  at the base of the food chain, resulting in correspondingly higher nitrogen ratios in humans (Bogaard, et al. 2007). Controlled experiments by Szpak et al. (2012) demonstrate that camelid dung fertilization can enrich nitrogen levels in maize plants by 1.8 to 4.2‰, varying by plant part (leaf, stalk, or grain).<sup>95</sup> Camelid dung fertilization was a widespread agricultural practice in the prehispanic Andes, and there is evidence of its use in agricultural terraces in the Colca Valley. High phosphorus and nitrogen levels reflect the accumulation of fertilizers, probably animal manure and burned vegetation, over a long period of time (Sandor 1986). The positive correlation of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values, which is observed in the Early LIP sample ( $r = 0.498$ ,  $p = 0.021$ ,  $N = 21$ ), has also been interpreted as the consumption of a resource enriched in both  $^{13}\text{C}$  and  $^{15}\text{N}$ , such as maize fertilized with manure (Finucane 2009: 540).

By the same token, the foddering of animals with maize and their consumption by humans may also explain this moderate correlation between  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  and the higher-than-expected  $\delta^{15}\text{N}$  values overall. In the present-day Colca Valley, camelid herds are brought down into the valley from the *puna* and allowed to feed on agricultural byproducts (Wernke, personal communication). It is possible that camelids occasionally grazed maize stubble in the prehispanic era, and isotopic analysis of camelid bones could test this hypothesis. Studies in other regions provide empirical evidence of the widespread practice of maize foddering in prehispanic times

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<sup>95</sup> Szpak et al. (2012: 3727) note that the effect of camelid dung on the nitrogen values of fertilized plants cannot be considered uniform across time and space; because “the diets of prehistoric camelids and the conditions under which dung may have been collected and stored differed markedly between and potentially within regions...it is...probable that the physical and chemical properties of camelid dung (including nitrogen isotopic composition) used for fertilizer were highly variable.” Regardless, the increase in plant  $\delta^{15}\text{N}$  is significant, especially since the Szpak et al. (2012) study only consider the effects of a single season of fertilization; other studies suggest the effect of mammalian fertilizers is more pronounced after years or even decades of use (see Szpak et al. 2012: 3728).

(Dufour, et al. 2014; Finucane, et al. 2006; Szpak, et al. 2014; Thornton, et al. 2011). They also report  $\delta^{15}\text{N}$  values of archaeological camelids upwards of 10‰, although values vary widely depending on diet and the local ecology (Torres-Rouff, et al. 2015). If camelid diet was indeed supplemented by maize, then the reported variation in  $\delta^{13}\text{C}$  cannot be interpreted solely with regard to the direct access and consumption of C4 plant sources. Forthcoming isotopic analyses of faunal remains and of human bone apatite, which reflect the whole diet, will be compared with  $\delta^{13}\text{C}_{\text{col}}$  values to more accurately estimate the proportion of plant and animal resources in the diet (Ambrose and Norr 1993).

Other nitrogen-enriched food sources must also be considered. As previously noted, *kiwicha* is substantially enriched in  $\delta^{15}\text{N}$ , exceeding average values of terrestrial animals and even the human average reported in this study. This indicates that *kiwicha* could not have been the primary source of dietary protein in the Colca Valley, but may have contributed to elevated values in a mixing scenario. Marine sources are not expected to have been regularly incorporated into the local diet. Nearly all samples from the Colca Valley fall below the typical range (14-15‰) reported for fish eaters (Schoeninger, et al. 1983). Yet, depending on the local food web, nitrogen values >12.5‰ could potentially indicate consumption of marine foods (Torres-Rouff, et al. 2012: 61). Thus, they cannot be excluded *a priori*. In fact, ethnohistoric sources recount that select communities in the Colca, namely, Sibayo, maintained rights to marine resources along the Arequipa coast, which they directly acquired on an annual basis (Cuadros 1977; see also Galdós Rodríguez 1987). However, low standard deviation in  $\delta^{15}\text{N}$  would mean that the incorporation of a far-flung resource into the diet was uniform and consistent across the population and throughout time. This seems unlikely.

Given the local ecology, it is most likely that high nitrogen isotope values reflect a significant proportion of animal protein in the diet. Terrestrial animals alone could theoretically account for the elevated mean  $\delta^{15}\text{N}$  if manuring and maize foddering worked synergistically to drive up nitrogen levels across the food chain. Alternatively, terrestrial animal, maize, kiwicha, and/or marine animals may have all contributed to dietary protein, in varying proportions, resulting in the "intermediate" values observed in this study. Simply stated, there is not enough data to distinguish between these myriad scenarios. Additional lines of isotopic evidence from humans ( $\delta^{13}\text{C}_{\text{ap}}$ ) and camelids ( $\delta^{13}\text{C}_{\text{col}}$ ), as well as paleoethnobotanical and zooarchaeological analyses from recent excavations of domestic sites stand to improve our reconstruction of the Colca Valley food web in years to come and enable the computation of multivariate mixing models to estimate dietary components (Kellner and Schoeninger 2007; Phillips 2012; Phillips and Gregg 2003).

Despite these unknowns, the isotopic analysis presented here makes two major contributions to our understanding of the consumption patterns in the Colca Valley, which heretofore have been analyzed indirectly by ethnographic analogy, agricultural models, or the analysis of landholding declarations from colonial *visitas*. First, this study suggests that a pastoralist subsistence base, a central element of Collagua identity, has a long time depth in the Colca Valley. Until now, it was “unclear to what degree the economic specialization of each group, documented in the colonial period, was the result of historical and cultural dispositions dating back to the LIP, or a consequence of economic strategies imposed during the Late Horizon” (Doutriaux 2004: 302-303). This study supports the former scenario, while not excluding the (likely) possibility that the Inka intensified pastoralist activities to increase the production of economically and socially valuable wool.

At the same time, this study suggests that pastoralist or agriculturalist subsistence strategies, while deeply entwined with social identity, did not result in qualitatively different consumption patterns. That is, the sample does not cluster into “subsistence groups” in the bivariate plot of carbon and nitrogen isotope ratios. Flannery et al.’s (1989: 28-36) discussion of modern-day herding communities in highland Ayacucho is instructive in this regard. They note that pastoralists “are in no sense a separate caste, lineage, or community,” but rather, belong to the same *ayllus* as do farmers. Ethnohistoric analysis in the Colca Valley also shows how herding practices were embedded within broader community structures that mediated access to resources from different ecological zones by way of vertical colonies or horizontal exchange (see Wernke 2013). Isotope results are in line with these ethnohistoric models, and suggest that social structures of exchange and verticality also equalized dietary profiles in gross perspective.

Importantly, these patterns cannot be extended to the Colca Valley population as a whole. Given their burial treatment, the individuals sampled were presumably of higher status, and may have maintained greater access to camelid meat or maize. Even so, within this “elite” segment there is significant intra-group variation that suggests other aspects of social identity—beyond a generalized ‘status’—mediated dietary practices. Subsequent sections will more closely explore intra-population variation and its patterning vis-à-vis burial location, sex, and cranial vault modification.

### *Burial Location and Resource Access*

The central question of the dissertation explores how the placement of the dead in above-ground sepulchers structured social relationships among the living. Chapter 3 presents two overarching models of mortuary behavior, which carry distinct implications for resource access

and exchange. In the “corporate group” model, the distribution of tombs on the landscape reinforces territorial and social divisions between competing kinship groups. It was hypothesized that the strict delineation of resource holdings would promote dietary differentiation between social groups that occupied separate burial spaces. In contrast, the “inter-group alliance” model positions mortuary practice as a key element in the structuring of cooperative social and exchange relationships between distinct lineage, political, or ethnic groups. It predicts that resource sharing will result in dietary homogeneity across all burial groups. It is also possible that the co-burial of individuals with diverse social backgrounds and dietary practices would be reflected by *within-group* heterogeneity in carbon and nitrogen isotope ratios. In either case, this integrative model of mortuary practice would not be expected to result in strong *between-group* differentiation.

Clearly, the data do not conform to expected patterns of variation under the “corporate group” model. As Figure 7.11 and Figure 7.12 illustrate, variation in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  does not cluster by burial location. Within-tomb variance is not consistently smaller than overall variance, which would be expected if individuals buried together had more similar diets than those buried apart (Table 7.3). Rather, diet is broadly similar across the burial population, suggesting that corporate groups partook in a shared agro-pastoral economy in which access to resources such as maize or camelid meat was not restricted, even if inequalities in total land and livestock holdings existed. Notably, average carbon and nitrogen ratios do not meaningfully differ between individuals buried at Yuraq Qaqa (CO-098) and those buried at Sahuara (CO-118). This is significant because the location of these mortuary sites to the east and west of the Chillihuitira maps onto known social boundaries in the late prehispanic era that differentiated the water management and land tenure practices of *ayllus* specifically and domestic settlements more

broadly (Velasco 2014; Wernke 2013). While this research does not negate the possibility that tombs marked boundaries between resource-holding groups, it does provide compelling isotopic evidence that the land tenure system in the Colca Valley did not result in significant dietary differentiation.

Because variation crosscuts burial groups, it is tempting to read the data as evidence that resource exchange leveled between-group variability, as predicted by the “inter-group alliance” model. However, upon close scrutiny, this scenario falters as an explanatory model. First, there is an issue of equifinality in that overlapping dietary variation does not necessarily signify resource sharing, but could result from *ayllus* maintaining separate, but similarly diversified resource bases. Secondly, if resources were shared equally by an “elite” substratum of society, through activities such as commensal feasting, we would expect relative dietary homogeneity across the sample; instead, the large range in  $\delta^{13}\text{C}$  values (7.1‰), even when an outlier is excluded (4.8‰), points toward considerable inter-individual variation in the consumption of prestige-laden foodstuffs, such as maize and or maize beer (*chicha*), that must be accounted for by factors other than burial location or general social class.

Intra-population variation in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  might support the inter-group alliance model along a different line of reasoning. That is, dietary variability could reflect “more expansive regional sampling of people, representing different subsistence strategies” (Kellner and Schoeninger 2008: 239). In this scenario, individuals with distinct social identities and geographic origins are buried together to reinforce social and political relationships between different polities (Carr 2006). While migration cannot be wholly discounted, local structures of social and subsistence variation, namely *ayllu*, can equally account for intra-population variation without invoking an outside force. As previously discussed, the data do not reflect wholesale



differences in subsistence that might be expected if, for example, individuals who lived most of their lives in the *yungas* or coastal zones were buried in the highlands. Therefore, the dietary isotope data do not tightly conform to either model. A more dynamic model is required to explore how multiple dimensions of social identity intersect subsistence and consumption patterns, both synchronically and diachronically—an issue that I explore more fully below.

### *Ethnicity, Gender, and Dietary Changes*

#### Sex-based Difference in Diet: Higher Protein Intake for Males

Slight isotopic variations between subgroups based on sex and cranial modification suggest that gender and ethnic identity mediate dietary practice. Higher average  $\delta^{13}\text{C}$  values among males ( $-13.77 \pm 1.48\text{‰}$ ) versus females ( $-14.69 \pm 1.24\text{‰}$ ) in the Colca Valley sample ( $N = 46$ ) show that contribution of C4 carbon to bone collagen was greater in males. Average  $\delta^{15}\text{N}$  is also approximately 0.62‰ higher on average in males ( $13.35 \pm 0.44\text{‰}$ ) than females ( $12.73 \pm 0.71\text{‰}$ ), which in part may be the result of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  covariation. Together, these findings suggest that men enjoyed privileged, but by no means exclusive, access to maize and camelid meat products. Indeed, if either camelids were maize-foddered or maize was dung-fertilized, a slight sex-based difference in the consumption of a single food source could potentially account for both elevated  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  among males.

Gender difference in diet has been documented in other cultural and temporal contexts in the Andes, but was by no means universal. Most dietary isotope studies in the Andes do not observe sex differences in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  from collagen (Finucane 2009; Finucane, et al. 2006; Kellner and Schoeninger 2008; Slovak and Paytan 2009; Tomczak 2003). This observation has led Tung et al. (2016) to suggest that, in the Wari imperial heartland, state policies and practices

may have contributed to the equitable distribution of resources, especially maize and camelid meat. Where differences are apparent, they are usually of a small magnitude ( $\leq 1.5\%$ ), with  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  trending higher in males (Hastorf 1991; Tomczak 2001: 140-142; Torres-Rouff, et al. 2015; Tung, et al. 2013). Gender inequality in diet can be interpreted in light of ethnohistoric and ethnographic models in which men consumed more maize in the context of feasting involving *chicha*, a fermented corn beer brewed through the Andean highlands in antiquity and the present day (Berryman 2010; Hastorf and Johannessen 1993). Ritual feasting is consistent with other archaeological evidence from the Colca Valley that points toward the consolidation of an elite class during the Late Intermediate Period. Because the effect of *chicha* consumption on overall  $\delta^{13}\text{C}$  values is unclear (see Gagnon, et al. 2015), this hypothesis should be considered provisional until supported by paleobotanical and ceramic evidence from the same time period (Hastorf and Johannessen 1993; Kellner and Schoeninger 2008).

#### Temporal Change in Diet: Shifting Gender Dynamics?

Chronological control in the Colca Valley between Early LIP and Late LIP samples enables the comparison of sex-based differences across a four-hundred year period. Did the nature of gender inequality in the Colca Valley remain stable through time or transform in the wake of momentous social and political changes? Although samples are small when partitioned temporally and by sex, results of comparative analysis support the latter—that women experienced a slight change in diet and social status during the 14<sup>th</sup> century. Male-female differences in the Early LIP are highly statistically significant, with males exhibiting higher carbon and nitrogen ratios. The magnitude of average difference in  $\delta^{13}\text{C}$  (+1.5%) is especially pronounced in the Early LIP. However, male and female dietary variability, as indexed by standard deviation, is similar.

The sex-based difference in C4 consumption largely disappears in the Late LIP, even though the highest  $\delta^{13}\text{C}$  values ( $> -13\text{‰}$ ) still come from males. Average  $\delta^{15}\text{N}$  remains lower for females, but their standard deviation from the mean increases by nearly twofold, which is evident by relatively large inter-individual spacing in the bivariate plot, compared to males (Figure 7.10). The minimum and maximum  $\delta^{15}\text{N}$  values in the Late LIP (11.08‰ to 14.13‰, respectively) exceed the absolute range (12.32-14.01‰) documented in the Early LIP, particularly in the lower extent. Related to this increasing heterogeneity is an uncoupling of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  covariation in the Late LIP, suggesting that differential access in C4-rich foods is no longer driving the male-female differentiation in diet. For example, women with  $\delta^{15}\text{N}$  values below the Early LIP minimum ( $N = 5$ ) exhibit heterogeneous  $\delta^{13}\text{C}$  values, ranging from -16.26‰ to -13.14‰. In other words, the components of the female diet become less predictable, whereas male dietary behavior is relatively stable over time. This suggests that other social, cultural, or environmental factors, mediated by gender, shaped dietary variation among females in the Late LIP.

#### Late LIP: Dietary Heterogeneity among Females

This shift in consumption patterns occurs around the same time that cranial modification dramatically increases in frequency, which I argue reflects the intentional construction of group distinctiveness, at least among the elite individuals buried in above-ground cemeteries. Could this process of ethnogenesis have reconfigured women's roles in Collagua society? The data seem to point in this direction. Modified individuals exhibit statistically lower  $\delta^{15}\text{N}$  values compared to unmodified individuals, and the relationship is stronger among females. In fact, of the nine modified females sampled from Late LIP contexts, five represent the lowest  $\delta^{15}\text{N}$  values of the entire sample. These individuals share a similar modification style that involved circular binding of the head and moderate to strong elongation of the vault. These observations, bolstered

by statistically significant comparisons outlined above (Table 7.6), strongly suggests that being female and being modified entailed particular social and subsistence behaviors that resulted in greater heterogeneity in diet.

A plausible interpretation of this finding must meet three requirements; first, it must explain differences that are, on average, smaller than a trophic level effect of +3‰. Second, it must account for dissimilarity among females in the modified cohort. After all, not all modified females have  $\delta^{15}\text{N}$  values in the first quartile, and C4 consumption varies widely among those who do. Finally, any explanation should be commensurate with cultural models of subsistence and labor in the highland Andes. Therefore, I hypothesize that small-scale isotopic variation in the Late LIP result less from social restrictions on diet, and more from differences in isotopic environment in which modified females lived during parts of the year. Specifically, I suggest that the seasonal movement of women between different ecological zones, in order to access or maintain communally held resources, could account for wider inter-individual spacing due to altitudinal variation in plant tissue  $^{15}\text{N}$  as well as differences in locally available crops.

Research on modern plants and animals shows that environmental factors, such as climate and aridity, and anthropogenic factors, such as manuring, can cause  $\delta^{15}\text{N}$  to vary widely between regions (Szpak, et al. 2012; Szpak, et al. 2013). Generally,  $\delta^{15}\text{N}$  isotopic values at the base of the food chain are highest in arid coastal environments and decrease with increasing altitude and rainfall, although the effect appears to level out above 2000 masl. Cultigens in the Andes can also vary widely in  $\delta^{15}\text{N}$ . On average, maize ( $6.4 \pm 2.2\text{‰}$ ) and quinoa ( $7.9 \pm 1.3\text{‰}$ )—the cultigens that were most common in the central Colca Valley during the early colonial period—are more enriched in  $\delta^{15}\text{N}$  than potatoes ( $4.0 \pm 5.5\text{‰}$ ), although isotopic values of the

latter vary widely (Szpak, et al. 2013).<sup>96</sup> Even if  $\delta^{15}\text{N}$  values of modern plants are not readily generalizable to the archaeological contexts, these large standard deviations are instructive and illustrate how nitrogen isotopic compositions are highly dependent on “local growing conditions (soil fertility, type of manure used) rather than any biochemical or physiological process specific to any particular plant species” (Szpak et al. 2013: 21).

If women were living in environments with different growing conditions (e.g. *kichwa* vs. *puna*) and subsisting off crops with lower baseline  $\delta^{15}\text{N}$  (e.g. potato vs. dung-fertilized maize) for just part of the year, such a change in diet could potentially widen an already operative disparity between the sexes in the consumption of nitrogen-enriched foods. Variation in  $\delta^{13}\text{C}$  would depend largely on locally available crops (C3 vs C4) and farming techniques in the area of temporary residence. Eating maize in a lower-altitude locale, where camelid manure was not regularly used, for example, could account for cases where  $\delta^{15}\text{N}$  is low but  $\delta^{13}\text{C}$  remains elevated relative to the sample mean. Regardless of the specific menu, seasonal movement back into the valley would, in effect, “average out” trophic level differences in bone collagen and produce the kind of small-scale variation observed in this study.

This hypothesis is informed by ethnohistoric evidence that suggests a high degree of residential mobility in the late prehispanic Andes. In the “vertical” economies of the highland Andes, members of a single family or household would split residency in different ecological zones to maintain their herds and agricultural fields (Gil Montero 2004; Nielsen 2009; Vining 2011). Examining indigenous economy and family structure in 18<sup>th</sup> and 19<sup>th</sup> Jujuy, Gil Montero (2004) defines home and family as distinct concepts and provides examples where residential

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<sup>96</sup> Turner et al. (2010) report similar values for plants from the Cuzco Valley. Their quinoa samples range in  $\delta^{15}\text{N}$  from 7.7-9.0‰. A single sample from maize is 7.8‰. Chuño (4.9‰) exhibits the lowest nitrogen value for a non-leguminous plant. These samples were from farms that did not use fertilizers.

mobility resulted in husband and wife living in different locales. Similar practices of dual-local residence probably existed in the Colca Valley. Archaeological sites located near bofedales in the *puna* may have served as temporary residences. Colonial *visitas* also identify pastoralist hamlets, where *ayllu* segments were settled to maintain the large herds of their *kurakas*, who resided in the agricultural core (Wernke 2013).

Camelid herd ecology also illuminates the logic of dual-local residence. Compared to llamas, alpacas are selective feeders, ill-adapted to life outside of the bofedal ecosystem (Vining 2011). Because they do not range widely, alpacas require continual rotation between different pastures (Markowitz 1992). If alpacas constituted the majority of herds in late prehistory, which is almost certainly the case in a pastoral economy oriented toward wool production, then it is reasonable to expect that a segment of the population lived most or part of the year in the *puna*, returning to the valley seasonally or for communal events and festivals. Today in the Colca Valley, families bring their herds back down to the valley during the rainy season, where they are allowed to graze on agricultural byproducts (Tripcevich 2007; S. Wernke, personal communication).

While dual-local residence, in and of itself, was not inherently sex-patterned, herding activities within modern-day highland communities tend to fall to women (Abercrombie 1998; Allen 2002: 342; Markowitz 1992).<sup>97</sup> A similar sexual division of labor, mediated by ethnic identity, may have operated in the past. If so, increased dietary heterogeneity in the Late LIP would actually reflect economic activity outside of the valley core and expanded access to non-local lands and products, rather than a normative change in female diet. At present, the primary shortcoming of this hypothesis is a lack of baseline isotopic data for the Colca Valley and

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<sup>97</sup> In contrast, most ethnographic accounts of llama caravan trade characterize it as a male domain.

neighboring regions, which make the environmental and dietary factors underlying a decrease in  $\delta^{15}\text{N}$  purely hypothetical, even if the mechanism of change (seasonal movement) is plausible. In the future, isotopic analysis of hair and teeth could directly test the hypothesis that diet among modified females shifted seasonally (see Knudson, et al. 2007).

Alternative explanations for increased dietary heterogeneity must also be considered. For example, it is possible that modified females immigrated into the Colca Valley from different regions, hence their more widely spaced isotopic ratios. That the magnitude of variation between males and females is so small, however, makes this hypothesis less likely. The overall isotopic “signal” of males and females is virtually identical (high  $\delta^{15}\text{N}$  and moderate  $\delta^{13}\text{C}$ ), and minor differences are more plausibly conceived as intra-population variation based on the relative proportion of foods consumed.<sup>98</sup> Women clearly had access to foods enriched in  $\delta^{15}\text{N}$ , including terrestrial protein sources; in isolation, their average  $\delta^{15}\text{N}$  still exceeds typical values for highland Andean populations. In addition, biodistance analysis of non-metric traits does not provide consistent evidence of sex-specific migration into the valley. Future research on oxygen and strontium isotopes will clarify the degree to which immigration into the Colca Valley affected dietary variation specifically and ethnogenetic processes more broadly.

## Summary

The isotopic analysis of carbon and nitrogen isotopes from bone collagen suggests that humans in the late prehispanic Colca Valley subsisted on a mixed C3/C4 diet that included foods substantially enriched in  $\delta^{15}\text{N}$ , possibly including but not limited to dung-fertilized maize and

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<sup>98</sup> That said, in-migration and residential mobility are not mutually exclusive. Systems of parallel inheritance involving the transferal of a mother’s land to her daughter could encourage movement between the husband’s community and matrilineally-inherited fields (Flannery et al. 1989).

maize-foddered camelids. Dietary reconstruction is considered tentative until additional lines of evidence can clarify the isotopic range and variability of multiple food sources in the Colca Valley food web. In sum, no significant differences in dietary isotopes were found between sites or time period overall. However, there are significant differences in  $\delta^{13}\text{C}$  between males and females and in  $\delta^{15}\text{N}$  between unmodified and modified individuals. In particular, females exhibiting circular cranial modification (N = 6) exhibit the lowest nitrogen values, but also higher heterogeneity in  $\delta^{13}\text{C}$ , relative to other subgroups based on sex and CVM.

Hypothetical models of mortuary practice and resource access do not adequately explain this variation in stable isotope ratios. Drawing from additional lines of archaeological, ethnohistoric, and ethnographic data, I propose that gender- and ethnic-based patterns of seasonal movement, resource procurement, and circulation through ecological “borderlands” can account for minor, but statistically significant, differences in diet. Increase in dietary heterogeneity among females in the Late LIP point to a lessening of gender inequality as it relates to food consumption patterns, and suggest that resource procurement strategies expanded during this dynamic era of social change. The relationship between ethnogenesis, gender identity, and diet will be explored in the next and final chapter.



## CHAPTER 8

### DISCUSSION AND CONCLUSION

#### Introduction

This dissertation explored how politics of conflict and cooperation during the Late Intermediate Period impacted lived experience and the treatment of the body at death. This research objective was advanced through the contextual analysis of human skeletal remains from above-ground mortuary monuments (*chullpas*) in the Colca Valley. In Chapter 3, two contrasting theoretical models were synthesized, which respectively highlight strategies of social differentiation and integration through mortuary practice: 1) a “corporate group” model in which the maintenance of strict boundaries between burial grounds reinforces an ethos of exclusion among landholding kin groups competing for scarce resources; and, 2) an “inter-group alliance” model, in which the integrated burial promotes marriage alliance, resource exchange, and social cohesion between social groups similarly faced with ecological and political turmoil. Counteracting the inherent functionalism of these and similar models, a bioarchaeological approach to mortuary politics shifts the focus away from identifying “groups” or “type” of burial organization to explore how exclusionary and inclusionary strategies of social interaction become embodied, operate synchronically at multiple nested levels of social interaction, and transform across time in accordance with shifting political exigencies.

In this chapter, I compare results from the bioarchaeological analysis of human skeletal remains to expected patterns of variation under the heuristic models of mortuary practice. The implications of bioarchaeological analysis for the nature of social interaction within (and beyond) the arena of mortuary politics are discussed. Specifically, dissertation results are

discussed in light of prevailing theories of mortuary monumentality during the LIP, which associate open sepulchers with semi-autonomous landholding kinship groups (*ayllu*). The next section addresses temporal variation in bioarchaeological indicators of social identity through the lens of ethnogenesis, exploring how dramatic changes in embodied identity were negotiated vis-à-vis large scale political transformations endogenous and exogenous to the Colca Valley. In the final section, I interrogate how the four-centuries-long tradition of ancestor veneration at open sepulchers worked to naturalize emerging social differences by emplacing an emergent Collagua identity upon the broader ancestral landscape that encompassed past and future time.

### Evaluating Models of Mortuary Practice

In Chapters 5-7, three lines of bioarchaeological evidence were brought to bear on the heuristic models of mortuary practice: cranial vault modification (CVM) presence and type, biodistance analysis of heritable cranial non-metric traits, and stable isotope analysis of carbon and nitrogen in adult bone collagen (as a proxy for diet). Under the corporate group model, it was hypothesized that bioarchaeological indicators of social identity will exhibit within-group homogeneity, but between-group heterogeneity. Under the inter-group alliance model, it was hypothesized that similarities across mortuary contexts would exceed differences between them, indicative of an integrative mortuary regime that fostered social cohesion or elite identity. What follows is a synthesis of the findings of this dissertation as they relate to these two hypotheses.

### *Summary of the Results*

- 1) **Cranial vault modification.** Prima facie, intra- and inter-site CVM patterning supports the inter-group alliance model, since individuals with and without cranial modification

were buried in the same mortuary chambers. This is especially salient at the above-ground cemetery of Sahuara, which includes both the pseudocircular (Collagua) and tabular erect (Cabana) styles of modification, as well as unmodified individuals. Although modified and unmodified individuals buried in the same sepulchers may have belonged to the same kinship group (as discussed below), burial location clearly did not reinforce symbolic boundaries based on CVM, as predicted by the corporate group model.

2) **Biological distance.** The corporate group model is supported by biodistance analysis of cranial non-metric traits. Both Mean Measure of Divergence (MMD) and Jaccard coefficients, which respectively measure inter-group distance and inter-individual similarity, demonstrate that individuals buried together are more phenotypically similar than those buried apart. This suggests above-ground tombs were, in part, organized around biological kinship. Biodistance analysis of phenotypic variability does not yield clear evidence of sex-specific migration into the valley, which would be expected if inter-group alliances promoted regular patterns of exogamy and exchange in marriage partners.

3) **Dietary variation.** Dietary variability is not correlated with burial location, suggesting that mortuary sepulchers did not reinforce social boundaries based on resource access. Stable isotope values of carbon and nitrogen exhibit greater within-tomb than between-tomb variation, but not at a magnitude that would reflect qualitatively distinct subsistence strategies (agriculturalist vs. pastoralist). Rather, most individuals maintained access to similar resources (maize and animal protein), but in varying proportions. Inter-individual variation in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  is dynamically interrelated with cranial modification and skeletal sex, which requires that the nature of social diversity at these mortuary sites be reconsidered.

In sum, the bioarchaeological data do not uniformly align with either heuristic model. As discussed in Chapter 3, an alternative hypothesis proposes that strategies of inclusion and exclusion based on kinship, gender, or other aspects of social identity will operate at multiple social scales that intersect, but are not reducible, to burial organization. In the case of the Collaguas, the disjuncture between multiple lines of bioarchaeological and mortuary evidence supports a dynamic model in which social diversity crosscut discrete burial groups organized around descent. Given that mortuary sepulchers include both modified and unmodified individuals and were likely organized around kinship, biological and perceived, the results of this dissertation provocatively suggest that modification “status”—reported by Ulloa de Mogollon (1965 [1586]) as a quintessential signifier of Collagua identity—was not ascribed to all members of Collagua society, much less any given social unit (e.g., lineage, household, or clan) during the LIP. The right to modify the head of a child, while embedded within corporate group structure, also transcended it. In life, the shared identity embodied by an elongated head shape may have worked to collapse social distance between distinct kinship groups and mobilize them into collective action against outside forces, such as the expanding Inka state.

In death, individuals with and without this conspicuous marker of identity were buried alongside one another—a powerful statement of social cohesiveness but also one that may have masked differences in lived experience. Indeed, as revealed by stable isotope analysis, dietary behaviors were strongly influenced by embodied identity and sex (as a proxy for gender), irrespective of burial location. That individuals buried together did not share the same life experiences, despite being members of the same kinship groups, requires a reexamination of the “*ayllu* model” as traditionally applied to late prehispanic mortuary practices, which I discuss below.

### *Revisiting the Relationship between Ayllus and Open Sepulchers*

While observed patterns of variation do not tightly correspond to Isbell's (1997) vision of *ayllu* as a fundamentally exclusive social structure, they find strong cultural analogs in Andean notions of personhood, social complementarity, and nested hierarchy (Albarracin-Jordan 1996; Gose 2008). Indeed, a more nuanced account of *ayllu*, one informed by ethnographic and ethnohistoric accounts but not determined by them, reveals dynamic fields of practice in which strategies of difference and affinity operate concurrently and situationally.

As discussed in Chapter 3, *ayllu* as a model of social relations is inherently flexible. Because *ayllus* were traditionally dispersed across multiple ecological zones, they have no fixed territorial correlate (Platt 1986). Ample ethnohistoric, ethnographic, and archaeological evidence attests to their nested, hierarchical organization, which “allowed for the coordination of resource exploitation and redistribution” at higher levels of inclusiveness (Albarracin-Jordan 1996: 187; Netherly 1984). By analogy, while mortuary chambers may have been organized into separate corporate groups (*ayllus*) at the minimal level, their agglutinative construction pattern “suggests linkages between chambers were just as important as their demarcation” (Velasco 2014: 460). Thus, what Mantha (2009: 11) describes as the “communicative nature” of mortuary buildings is largely a matter of scale and perspective. Ritual activities at Yuraq Qaqa may have emphasized individual identity, household longevity, or moiety-level solidarity, depending on the social or temporal context. Interpreting open sepulchers as evidence of ancestor veneration tell us little about *ayllu* relationships on-the-ground—that is, who achieved the status of “ancestor” and who participated in their “veneration.”

Most studies of above-ground funerary structures in the Andes utilize architectural and survey data to make inferences about boundary formation and social fragmentation along kinship or ethnic lines (Hyslop 1977; Isbell 1997; Kesseli and Pärssinen 2005; Mantha 2009). By prioritizing burial structures at the expense of the bodies that dwelled in their confines, *chullpas* come to ‘stand for’ coherent, homogenous social units, while intra-group diversity remains undertheorized. Yet, embedded diversity is a hallmark of the *ayllu* and moiety structure, which ideally incorporates individuals and groups differentiated by place of origin, rank, ecological verticality, and craft or subsistence specialization into relationships of complementarity (Gose 2008; Janusek 1999; Paerregaard 1992). As discussed in Chapter 7, herders and cultivators can belong to the same *ayllus* (Flannery, et al. 1989), although asymmetries in rank between *ayllu* segments, or between *kuraka* leaders and their subjects, structured inequalities in agricultural and pastoral resources (Cock Carrasco 1977; Wernke 2013). Platt (2009) also illustrates how the lived experience of *ayllu* affiliation and multi-ethnic residence is fraught with tensions between allegiance to an encompassing moiety and situational alliance with neighboring (but opposing) *ayllus*.

Results from Chapter 5 and 6 suggest that corporate group cohesion based on biological relatedness and shared mortuary practices exists alongside (or in tension with) other markers of group affiliation, such as cranial vault modification, that were not assigned to all members of burial/household group. Building off a model of interdigitated multilingualism, Mannheim et al. (in press) posit that cranial modification indexes locality, rather than ethnicity, and that within-tomb CVM diversity, as well as the presence of modified and unmodified people buried together, reflect households of mixed composition. If modification inheres in the individual, and is not reducible to *ayllu* or ethnic affiliation, what then does it mean to be modified? Cranial vault

modification, as an embodied signifier, probably operated along multiple social scales, both within but also outside of the minimal *ayllu*. To bilateral kin and affines, head binding may have marked a kinship category (e.g., first-born) which granted the modified person certain rights or privileges with regard to land and resources (Kurin 2016b). To competing social factions, this embodied identity may have constituted a form of affiliation that cut across kinship boundaries and provided a symbolic basis for inter-group cooperation. Finally, to ethnic “outsiders,” an elongated head provided a visual cue in ethnic borderlands that signaled an individual’s place of origin or political affiliation, and thereby structured the terms of engagement—whether in barter or battle.

Yet other interpretive issues arise when equating open sepulcher with *ayllu*. First, the role of status and class must be considered a factor in mediating access to open sepulchers. In the Lake Titicaca Basin, elaborate *chullpas* with Inka-style masonry served to reinforce hierarchical distinctions and facilitate elite alliance; yet the wide distribution of more rustic *chullpas* show that above-ground funerary customs were not exclusive to a single social class (Stanish 2003; Stanish 2012; Tantaleán 2006). In the Colca Valley, ‘abutted’ *chullpas* built along cliff faces, like the tombs of Yuraq Qaqa, are rare relative to other tomb types, such as rustic burial caves and subterranean cist tombs (Doutriaux 2004; Wernke 2013). Their elaborate construction and prominent placement on the landscape suggest they were reserved for higher-ranking segments of society. The demographic profile of skeletal remains from Yuraq Qaqa, in which infants and children are under-represented, supports this assertion (Appendix B; Velasco 2014). These observations should caution against reading corporate group structure into burial organization, as it potentially masks the complex political hierarchies and social relationships that shaped patterns of inclusion and exclusion at mortuary monuments, in different regions and across time.

This brings us to a final point: there is strong evidence that the social identities of those who were permitted burial in these open sepulchers dramatically transformed over time, despite strong continuity in material culture and mortuary practice. As argued in Chapters 5 and 7, temporal variation is a key factor, if not the most important one, for explaining patterns of CVM prevalence and dietary diversity. Drawing from theories of ethnogenesis, the next section will analyze this transformation in social identity and its impact on lived experience and treatment of the body at death, within the political context of late prehispanic state formation.

### Ethnogenesis on the Eve of Inka Expansion

An important finding of this dissertation was that bioarchaeological correlates of social identity were neither homogenous among the elite stratum buried in open sepulchers, nor stable over time. Fifteen radiocarbon dates were used to divide mortuary contexts and human skeletal remains into samples from the Early LIP (A.D. 1150-1300) and Late LIP (A.D. 1300-1450). Significant change in CVM prevalence and dietary diversity were observed across time. To explain this change, I draw from theories of ethnogenesis because they emphasize an understanding of ethnicity as *process*, whereby “group distinctiveness” (sensu Sturtevant 1971) is consciously and intentionally produced within particular historical contexts to advance diverse political goals, from the creation of imperial order to its dismantling (Hu 2013; Stovel 2013; Voss 2015; Weisman 2007).

Rather than debating whether CVM marked a primordial “ethnicity” based on common descent, language, and ideology, I explore how embodied identity in the Colca Valley impacted patterns of social cohesion and inequality among communities confronted by widespread conflict and encroaching Inka hegemony in the latter half of the Late Intermediate Period. Specifically, I



argue that the increasing prevalence of CVM in the Colca Valley represents the intentional construction of a new kind of identity that provided a symbolic basis for inter-group coordination vis-à-vis outside threats, including but not limited to the Inka state. At the same time, head binding probably conferred a privileged status to select individuals, and especially women, enabling their broader participation in the local and regional political economy. As such, this process of making “group distinctiveness” had real, tangible effects on lived experience and likely widened social disparities within communities.

### *Identity Formation in the Late Prehispanic Andes*

In recent years, theories of ethnogenesis have gained traction in archaeological and bioarchaeological circles as a framework for understanding how “new” identities emerge in relation to large-scale social processes, such as warfare, state formation, colonization, creolization, and institutional marginalization (Hu 2013; Weik 2014). Although scholarly works within this paradigm of research share a concern with how identities are intentionally constructed through habitual practice, they vary in their emphasis on long-term continuity or change, and whether or not ethnogenesis occurs from the top down or bottom up (Voss 2015). Ethnogenetic processes can range from the fusion of diverse social groups who create social cohesion as a means of resistance, to the fomenting of subject identities by state actors, in the interest of facilitating governance and political order (Ogburn 2008; Weisman 2007). Thus, ethnogenesis may involve both subaltern and elite actors, although Voss (2015: 666) opines that “the relative lack of archaeological attention to ethnogenesis among elite and dominant communities has been a fault of much ethnogenesis research to date” (but see Bell 2005).

Because ethnogenesis takes hold in diverse historical settings and is enacted by diverse social actors, it is necessary to sketch the late prehispanic political landscape upon which ethnic factionalization emerged. The traditional picture of ethnogenesis in the pre-Inka and Inka worlds derives largely from the ethnohistoric record, which recounts how the Inka encountered and subjugated diverse ethnolinguistic groups in order to establish their expansive empire. The Spanish chroniclers describe several strategies the Inka used to incorporate, manage, and pacify the groups they conquered, ranging from the marriage alliance and respect of autochthonous traditions, to the forced resettlement or outright annihilation of bellicose groups (Garcilaso de la Vega 1966 [1609]). In some instances, the Inka directly cultivated ethnic identity by changing local customs of dress and cranial modification, in effect spurring ethnogenesis from the top-down (e.g., Cieza de León 1984 [1553]; Pachacuti Yamqui 1993 [c. 1613]; see also Blom 2005, Ogburn 2008). However, such accounts, written in the early colonial period, predominantly reflect an elite Inka version of history, in which pre-Inka peoples are portrayed as barbarians without order (*behetria*), dwelling in a dark age before the arrival of the Sun (see Kosiba 2010). This ethnic ‘othering’ is in plain view in the drawings of Felipe Guaman Poma de Ayala, which render subject peoples in dyadic opposition to the Inka, locating difference in their respective headdresses, head shape, and facial beauty or disfiguration (Ogburn 2008).

Archaeological research can critically engage the ethnohistoric record by approaching dynamic local and regional processes of identity formation and political reorganization during the Late Intermediate Period from a bottom-up and diachronic perspective. Research in the imperial provinces draws attention to the different political and ecological factors that conditioned Inka strategies of governance and regional expressions of ethnic identity vis-à-vis the expanding state (Doutriaux 2002; Malpass and Alconini 2010). Provincial elites, or ethnic

lords, played an important part in this colonial encounter by negotiating between local community prerogatives and imperial demands for labor and tribute (Wernke 2006a). The establishment of mutually beneficial alliances with the Inka also buffered against pre-existing ethnic antagonisms in the frontier zones (Alconini 2010). By focusing on local political dynamics, these studies nuance the traditional (cultural-historical) depiction of neatly bounded ethnic territories, showing how these boundaries were neither primordial nor imposed, but rather situational and interactional.

Several scholars also explicitly employ a framework of ethnogenesis for understanding how novel ethnic or political entities emerged *prior to* Inka incursion in the wake of the collapse of the Wari and Tiwanaku polities around A.D. 1000-1100 (Kurin 2016b; Sutter 2009; Toohy 2009). Sutter (2009: 122) characterizes post-Tiwanaku ethnogenesis in the Moquegua Valley as a process of fusion and aggregation, in which former Tiwanaku colonists, indigenous coastal peoples, and other “economically defined ethnic groups” created a shared Chiribaya ethnic identity through intermarriage and economic exchange. In post-collapse Andahuaylas, however, ethnogenesis among Chanka-affiliated groups involved a cultural rupture from the previous period of Wari rule (Kurin 2016b). The widespread adoption of cranial modification practices, absent during the preceding Wari era, signaled the creation of a new ethnic identity. Kurin (2016: 121) interprets Chanka ethnogenesis as a strategy of boundary formation “which mediated radically restructured interpersonal relationships in the aftermath of Wari collapse.”

Similar to Kurin’s (2012; 2016b) findings, cranial modification frequencies in the Colca Valley dramatically expand during the Late Intermediate Period, increasing from 39% to 73%. I interpret this pattern as signaling the intentional construction and concretization of a ‘Collagua’ ethnic identity. However, Collagua ethnogenesis occurs primarily in the Late LIP (A.D. 1300-

1450), significantly postdating the Wari/Tiwanaku collapse.<sup>99</sup> Moreover, the social experience of being modified in LIP Colca Valley dramatically differed from Andahuaylas, where marked individuals were disproportionately targeted for lethal violence, in what Kurin (2016) interprets as a case of ethnocide. Instead, I argue that cranial modification in the Colca Valley context conferred particular social benefits, especially among females. This contrast will illustrate how distinct historical and geopolitical conditions shaped the trajectory of ethnogenetic processes in the late prehispanic Andes.

Previous archaeological research in the Colca Valley provides clues to the political and social milieu in which Collagua ethnogenesis took hold. During the Late Intermediate Period, there is compelling evidence of emergent social inequalities, signaled by increasing disparities in house construction, mortuary treatment, and total wealth in land and livestock holdings (Wernke 2013). At the same time that communities are becoming more internally differentiated, there is a greater investment of time and labor in the construction of defensive architecture at hilltop forts (Kohut 2016). How might the standardization and increase in cranial vault modification practices relate to these material indicators of status differentiation, wealth inequality, and social conflict? Furthermore, how does this salient shift in the way identity is marked and embodied relate chronologically and politically to processes of Inka state formation in the 14<sup>th</sup> and 15<sup>th</sup> centuries? By weaving together diverse strands of lived experience and tracing their emergence in history, the bioarchaeological approach allows us to situate the consolidation of a Collagua ‘ethnic’ identity in relation to other structures of difference, namely kinship and gender.

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<sup>99</sup> As discussed in Chapter 2, the Colca Valley never came under direct control of the Middle Horizon polities.

### *Intersections of Gender and Kinship in the Embodiment of Ethnic Identity*

My analysis of CVM and diet in Chapter 7 illustrated how the embodiment of ethnic identity resulted in micro-scale variations in diet that likely signify gender-based subsistence and mobility practices. In the Early LIP, significant inter-sex differences in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  suggest that males maintained greater access to maize and meat, consistent with a political economic model of male feasting (Hastorf 1991). In the Late LIP, however, this contrast in resource access becomes less stark. Nitrogen values for females, while remaining lower on average, exhibit a larger absolute range in the LIP, and there is no longer a difference between males and females in  $\delta^{13}\text{C}$ , used as a proxy for C4 consumption. Modified women, in particular, drive the increase in dietary heterogeneity in the Late LIP, representing the highest  $\delta^{13}\text{C}$  and lowest  $\delta^{15}\text{N}$  values for the entire female sample. However, even for modified females with low nitrogen values (<12‰),  $\delta^{13}\text{C}$  ranges by more than 3‰, indicating their diet was not homogenous.

Thus, while head binding—in and of itself—does not mark a gender distinction (i.e., males and females exhibit CVM at similar rates), it does appear to have differentially shaped women's dietary practice, enabling access to a more diverse array of resources. Ongoing analysis of cranial trauma data also suggests that being modified mediated exposure to violence among women. From Late LIP contexts, less than a third of modified females exhibit healed trauma, compared to ten of 11 unmodified females who suffered a blow to the head or face. Although trauma rates are relatively high in the Colca Valley overall (>50%), only modified females experience a marked decline in trauma from the Early LIP to Late LIP, strong evidence of differential life experience (Velasco 2016).

The complex relationships between skeletal sex, cranial vault modification, and bioarchaeological indicators of lived experience call for a critical examination of the intersection

of gender and ethnic identities in the late prehispanic Colca Valley. Because sexual politics are often entangled in the negotiation of insider/outsider boundaries, Voss (2015) exhorts bio-archaeologists studying ethnogenesis to engage with theories of gender and sexuality. Nagel (2000: 113) conceptualizes this gender/ethnicity nexus as an ‘ethnosexual frontier’ that is “regulated and restricted” but also “constantly penetrated by individuals forging sexual links with ethnic ‘others.’” Asymmetrical gender ideologies and norms of ethnic purity govern who is or is not permitted to cross these boundaries, and whether by choice or coercion. Greene’s (1996) historical analysis of changing clan organization among the Anlo-Ewe of western Africa illustrates this point. As outside ethnic groups moved into the region and competition over scarce resources increased, women lost autonomy and inheritance rights, for fear they would marry “outsiders.” Thus, the negotiation of “we/they” relations—central to the ethnogenetic process—necessarily implicates norms of proper marriage, sexual behavior, and female agency.

Did ethnogenesis in the Colca Valley similarly involve the regulation or crossing of ethnosexual frontiers? Intriguingly, the ethnohistoric record recounts the tale of a marriage alliance between a Collagua princess and Inka lord, and regardless of its veracity, it asks us to consider how Collagua women may have been entangled in the sexual politics of alliance formation, economic exchange, and imperial conquest. Although the present case study cannot fully address the complex power dynamics of “wife-taking” in the past, one could hypothesize from their dietary heterogeneity that modified females represent in-marrying outsiders who gradually assimilated to local foodways. Indeed, biodistance analysis in Chapter 6 sought to examine virilocal and uxorilocal marriage practices through the analysis of sex-specific patterns of phenotypic variation. Results from the analysis of Jaccard coefficients are inconsistent and do not conform to expected patterns of variation under either system of residence. Nevertheless, the

possibility that *some* modified females migrated (or were brought) to the Colca Valley cannot be ruled out and must be investigated through future isotopic and ancient DNA research.

Although it remains to be determined if and how Collagua ethnogenesis restructured ethnosexual frontiers, there is a stronger basis for hypothesizing that it reconfigured female gender roles, subsistence behaviors, and perhaps even rules of inheritance. In Chapter 7, it was argued that small-scale variation in the diet of modified females could reasonably result from seasonal movement between different ecological zones (with distinct food webs), in the interest of maintaining a diversified resource base. Some support for this hypothesis comes from ethnographic models of dual-local residence in the Andes, where family members live separately for parts of the year to maintain resources in marginal environments. A related possibility is that modified females participated more broadly in herding activities involving seasonal movement between the high altitude flat lands and the fertile valley zones. In either case, the binding of a female child's head may have entitled her to lands or resources belonging to her mother or grandmother, according to a system of parallel inheritance (Lambert 1977; Silverblatt 1987; Zuidema 1977). Growing up and participating more extensively in the agropastoral economy may have brought women into more frequent contact with outsiders at ecological borderlands, where their head shape served as a unique identifier that at once signaled social, political, and economic identities.

Ultimately, this hypothesis remains tentative, awaiting the application of isotopic techniques, such as strontium and oxygen isotope analysis of multiple tissues, that can directly address seasonal and occupational mobility (Knudson, et al. 2007; Knudson, et al. 2014; Knudson and Price 2007; Knudson and Tung 2011).

### *The Impact of Inka State Formation*

Clearly, the Late Intermediate Period was a time of profound social change in the Colca Valley that witnessed the consolidation of Collagua ethnic identity and transformation of gender relations, most likely in concert with incipient social stratification that allowed certain social groups to maintain privileged access to local and non-local resources, higher-quality houses, and elaborate mortuary sites (Wernke 2013). From a broader regional perspective, ethnogenetic processes in the Colca Valley must also be situated upon a shifting political landscape that witnessed the rise of the Inka state. Did this transformation in status and social diversity at the local level stem from Inka social engineering, an attempt to manufacture “difference” in the interest of governance?

The bioarchaeological and radiometric evidence presented in this dissertation suggest that changes in CVM prevalence and practice were neither the result of a top-down imperial imperative nor the adoption of “external customs,” as has been hypothesized for other regions in the Andes (Andrushko 2007; Gerszten 1993). First, CVM practices, including both circular and tabular types, are present in the Colca Valley from at least 13<sup>th</sup> century. Moreover, the 2-sigma ranges for calibrated radiocarbon dates fall between A.D. 1046-1443, which is entirely before the supposed onset of Inka imperialism (i.e., Late Horizon) circa A.D. 1450-1470. In addition, as detailed in Chapter 5, variability in the location of pad impressions, angle of modification, and degree of cranial elongation suggests that head binding techniques were not strongly standardized across society, which would be expected if cranial modification was centrally regulated or performed by a class of ritual specialists with shared tools, training, and technique (Kuzminsky, et al. 2016). The persistence of “non-modification” at moderate frequencies in Late



LIP contexts (~25%) further argues against a scenario where cranial modification was imposed homogeneously on the entire population in order to cultivate a provincial ethnic identity.

Nevertheless, these findings do not wholly discount an Inka role in ethnogenetic processes in the Colca Valley; they only require a more dynamic model that contextualizes ethnogenesis within local and regional political trajectories. New ways of marking social difference in the Colca Valley may have emerged *in relation* to growing Inka hegemony, even if it was not a direct consequence of imperial control. In fact, there is good reason to question the traditional chronology of Inka conquest and instead rely on chronometric and archaeological evidence for inferring the onset of direct influence or conquest (D'Altroy, et al. 2007; Ogburn 2012). Using three <sup>14</sup>C dates associated with the construction of an Inka military outpost, in conjunction with a close reading of ethnohistoric sources, Ogburn (2012) challenges Rowe's (1945) chronology, which places the conquest of southern Ecuador in the mid-A.D. 1460s. He argues that the incorporation of the Cañari ethnic region likely occurred one to two decades earlier. The Late Horizon could be pushed back even further for the southern provinces in Argentina and Chile (D'Altroy, et al. 2007; Schiappacasse 1999). Finally, Inka influence or hegemonic control almost certainly emanated from Cuzco well in advance of territorial expansion (Bauer 2004: 88). Pärssinen and Siiriäinen (1997) argue that political and economic exchange between the Inka state and Aymara polities of the Lake Titicaca Basin extends back to the 14<sup>th</sup> century. Inka-style ceramics in strata that predate A.D. 1450 most likely signal local imitation of prestige goods rather than direct import of products from Cuzco.

Although the Colca Valley lacks a rigorous late prehispanic chronology based on the excavation of intact stratigraphy, there is circumstantial evidence that points toward early Inka influence in the upper valley. The largest mortuary chamber at the Yuraq Qaqa (Chamber 35)

boasts a high frequency of obliquely modified crania (52%, N = 73) and the highest density of Collagua-Inka ceramics, a local style with Inka influence in design motifs (Ferrando Verástegui and Velasco 2014). In addition, the only possible Inka imports recovered during excavations, including a small vase with checkerboard motif, were found in this mortuary context. Both <sup>14</sup>C dates from bone associated (albeit loosely) with these material remains fall almost entirely within the 14<sup>th</sup> century (2σ cal A.D. 1311-1404 and A.D. 1301-1400, respectively). From terraces at nearby site of Chijra, Malpass (1986) reports a Late LIP date (580 ± 90, cal A.D. 1297-1442) associated with Late Horizon ceramics. These dates tentatively suggest Inka influence in the Colca Valley prior to A.D. 1450, calling into question the relevance of Rowe's (1945) chronology for the Arequipa region.<sup>100</sup> Admittedly, neither looted above-ground structures nor terrace fill offer ideal archaeological contexts for dating material cultural remains; for example, it is possible that Collagua-Inka ceramics were added later to tombs by subsequent generations. Yet, considering the Colca Valley's position in inter-regional exchange networks throughout prehistory—and the important role the region's pastoralism and maize agriculture would play in the Inka political-economic system—it is not inconceivable that direct or indirect ties between Cuzco and Collagua elites resulted in the diffusion of Inka artistic canons and prestige goods, perhaps decades before the region's incorporation into the empire.

If we accept the premise of an early Inka influence in the Colca Valley, what does this suggest about the causes and effects of ethnogenesis? I argue that the social imperative to define one's identity likely intensified as Inka hegemony spread across the southern Andes and contact between foreign groups increased (Barth 1969). Under this dynamic model, modification

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<sup>100</sup> It should be noted that the conquest of the Arequipa region in general, is only sparingly mentioned in the sources Rowe (1945) deems reliable. Rowe (1945: 272) states that “it was apparently conquered either by Pachacuti or Topa Inca, and our only evidence outside of Garcilaso is from Morúa, whose chronology is hopelessly confused.”

“status,” conferred at birth according to local structures of inheritance and privilege, may have enabled broader participation in regional networks of exchange and prestige, perhaps by virtue of birth right or social occupation. This dynamic interplay between inscribed identity and lived experience highlights the subjective and objective elements of ethnogenesis (Stojanowski 2010: 79-80). That is, parents or close kin exercised a measure of agency in modifying the head of a newborn, but how the kind of social person produced by this act was perceived by others—friend and foe alike—would have strongly conditioned the decision to modify with each successive generation.

For women especially, cranial modification appears to have mitigated gender inequality and conferred tangible social benefits, including more diversified resource access and partial protection from violence (Velasco 2016). It is important to consider how this privileged status may have intersected the prestige economy of an incipient state such as the Inka. If modified women were involved in mobile pastoralist activities, as I suggest in Chapter 7, then they likely played an important role in raising camelids for fiber production, which was central to Collagua political economy by the colonial period, and probably much earlier (Wernke 2013). Evidence from settlement data suggests the Inka intensified pastoralist production in the upper reaches of the valley (Wernke 2013). For the Inka, camelid-fiber garments signaled the social status of the wearer and were purportedly regarded as more valuable than gold (Murra 1962). Perhaps the proximity of Collagua women to the productive base of these elite prestige valuables bolstered their social status and underwrote the ‘negotiating power’ of the social groups in which they were embedded (Covey 2006).<sup>101</sup>

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<sup>101</sup> In the context of marriage alliances between the Inka and subordinate groups, Covey (2006: 124) writes that alliance-making was sometimes “initiated by elite women themselves...[who] appear to have possessed camelid herds and the right to labor tribute from their natal communities, meaning that given patterns of virilocal residence described in the chronicles, marriage alliances would benefit the wife-taking community.” Ethnohistoric

The notion that specific segments of Collagua society were preferentially positioned vis-à-vis the Inka state fits well with Wernke's (2003; 2013) archaeo-historical analysis of *ayllu* onomastics and land tenure, which shows that higher-ranking groups maintained autochthonous social divisions and preferential access to land, relative to lower-ranking groups which were restructured into a distinctly Inka "tripartite" social organization. If cranial modification conferred privileged status, as I have argued, then perhaps the embodiment of Collagua identity, in part, mediated the terms of engagement with the Inka state. Notably, social transformations during the Late LIP may have *preceded* the kind of direct social engineering that Wernke (2013) reconstructs. If so, then it is conceivable that they represent an initial phase of a broader ethnogenetic process that spans the transconquest era. Perhaps the incipient social inequalities marked by cranial modification were formalized within the Inka political hierarchy and further reified by a Spanish colonial apparatus grafted onto antecedent administrative and economic structures. Alternatively, or concomitantly, the performance of Collagua identity may have changed from a prerogative of the elite to a descriptor for an entire population, crystallized in Ulloa Mogollón's (1965 [1586]) account of ethnic diversity in the Colca Valley.

In sum, Collagua ethnogenesis appears to have been an elite-directed transformation in social identity that at once naturalized local structures of difference while also providing a symbolic basis for supra-*ayllu* coordination among individuals similarly modified but belonging to different corporate kinship groups. If the embodiment of Collagua identity also facilitated interaction at cultural borderlands and broader participation in the pastoralist economy, as I have

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observations of marriage alliances, in which ties to the wife's natal community were maintained, generate a new hypothesis that cannot be addressed with the available evidence; that modified females represent exogamous women who returned to their natal community for burial.

hypothesized, then perhaps modified individuals acted as “cultural brokers” on a socially and politically fragmented landscape.

### *Alternative Hypothesis: Migration and Diaspora*

An alternative hypothesis is that the increased frequency of modified individuals represents an influx of migrants into the Colca Valley during the mid-LIP, rather than an *in-situ* process of ethnic identity formation. Goldstein (2015: 9203) explicitly contrasts diaspora and ethnogenesis as alternative strategies of affiliation and difference, juxtaposing “the conservation of multi-ethnic distinctions against the reinvention of new hybrid identities.” Because diaspora offers a widely different account of social and political change in the Colca Valley, one that resonates with mytho-historical narratives that place Collagua origin outside of the valley, it merits careful consideration.

The three lines of bioarchaeological evidence examined in this dissertation do not support a scenario of diaspora.<sup>102</sup> First, head shaping traditions in the Colca Valley appear to represent a local variant of a widespread tradition, having developed over the long durée of centuries. Secondly, if modified individuals represent a diasporic group, their incorporation into different social groups, as inferred from ‘mixed composition’ of burial groups, would theoretically drive down between-group biological differentiation (Stojanowski and Schillaci 2006). The biodistance results presented in Chapter 6 instead suggest that phenotypic variation, regardless of modification status, is patterned on burial location. Finally, while stable isotopic data do reveal dietary heterogeneity at the intra-community level, inter-individual differences appear to be of degree rather than of kind. That is, individuals probably varied in the proportion of locally

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<sup>102</sup> Other material culture evidence from Colca Valley also undermines the diaspora scenario. Ceramic form and style do not evince subgroup boundaries; rather, the Collaguas and Cabanas shared ceramic and mortuary traditions.

available foods that they consumed (and when they consumed them). Only the  $\delta^{13}\text{C}$  value of one individual truly falls outside of the range of ‘local’ variation (here defined conservatively as three standard deviations from the mean), suggesting he lived most, if not all, of his adult life in a region where maize was not intensively cultivated.

However, it must be explicitly stated that the research design was not developed to examine migration scenarios into the Colca Valley. Stable isotopic data from bone collagen, in isolation, are of limited value for identifying migrants (but see Cook and Schurr 2009). Furthermore, the bioarchaeological correlates of diaspora would differ between first- and second-generation migrants. More complex scenarios, combining migration and in situ ethnogenesis through a framework of transculturation, should be investigated in the future.

#### Mortuary Politics: Making Social Order, Masking Social Change

The central premise of this dissertation is that the act of burial itself is a fundamentally political act, and therein can provide important insights into strategies of social integration and differentiation in the midst of widespread conflict during the late prehispanic era. Clearly, the present study and previous research in the region reveal that the Colca Valley witnessed profound social transformation during the pre-Inka and Inka periods. Communities became increasingly segregated as local elites parlayed social or political affiliations into preferential access to land, livestock, living spaces, and burial treatment. The practice of head binding probably helped consolidate widening social disparities by inscribing privileged status onto the body from birth. This ethnogenetic process also reconfigured social differences between males and females—and among females, in particular. Greater dietary heterogeneity among Late LIP modified females can be interpreted as evidence of a more wide-ranging participation in the

agro-pastoralist economy, or as the influx of women to the Colca Valley from different ecological zones. Regardless, dietary boundaries during the Late LIP appear less rigid than in the preceding period, which suggests that patterns of resource access and/or community integration dramatically transformed prior to Inka conquest. How then were these myriad, but interrelated social transformations manifested in or negotiated through the mortuary practice?

While the Inka selectively restructured political and kin-based hierarchies in the Colca Valley (Wernke 2006; Wernke 2013), there is no evidence that they radically transformed or reorganized local burial practices.<sup>103</sup> This is in contrast to other regions where *chullpa* burial practices shows clear signs of Inka influence (Nielsen 2016; Tantaleán 2006). At Yuraq Qaqa, above-ground tombs exhibit remarkable consistency in architectural style, construction technique, and placement on the landscape. General architectural features of mortuary construction, including roofs, access points, and other decorative elements do not appreciably transform over time, although in general, tomb size increases across successive stages of construction, which may signal population expansion or an increasing emphasis on mortuary communalism (Velasco and Rodríguez Sotomayor 2014). Overall, the data point toward a continual process of building and site expansion that lasted for centuries (Velasco 2014). The accretive development of the mortuary site, in which later tombs were built on top and alongside earlier chambers, draws attention to the symbolic (if not directly genealogical) linkages between past and present ancestral cohorts.

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<sup>103</sup> However, it is notable that all 13 radiocarbon dates from Yuraq Qaqa fall before A.D. 1450 in their 2-sigma range. Specifically, the radiocarbon age of Chamber 015, which based on the architectural sequence is thought to have been built during one of the final phases of construction at the main sector of the site is  $584 \pm 21$  B.P. (cal A.D. 1327-1435). Did active construction and burial at Yuraq Qaqa cease around the mid-15<sup>th</sup> century, even as the site continued to exert its ancestral presence on the surrounding landscape? Could elite burial have been relocated to another cemetery during Inka rule? A possible candidate was observed by Wernke (2003: 227) near the primary settlement of Uyu Uyu during reconnaissance of the central valley in 1998, but was destroyed shortly thereafter by modern terrace construction (Wernke 2003: 227).

As I have previously argued (2014: 462), *chullpas*, as “the visible foundations of social continuity...actively promoted an ideology of permanence and unchanging tradition, in effect, erecting what Morphy (1995: 204) calls a ‘mythic screen’ over contingent and contested social relationships.” The bioarchaeological findings of this dissertation provide a glimpse into these historically contingent relationships and reveal how they dramatically changed across the Early and Late LIP. Despite changing dietary and body modification practices across time, males and females, modified and unmodified individuals, were buried in the same sepulchers. In this way, the profound social transformation signaled by the expansion of head shaping practices across society was made legible and timeless through its incorporation into long durational mortuary tradition. The “communicative nature” of this mortuary act is clear: *We were always Collagua*.

There are mounting case studies across the southern Andes that richly contextualize the processes of ‘memory work’ surrounding *chullpa* burial practices, complementing existing research on their spatial and architectural configurations (Chacaltana Cortez and Núñez Flores 2014; Nielsen 2008; Nielsen 2016). Nielsen (2008) presents a case from the site of Laqaya in the southern Bolivian altiplano, where three *chullpa* towers are located around a central plaza. This arrangement may represent a tripartite social organization (i.e., Collana-Pahana-Cayao) that structured public ceremony and feasting. Notably, homogeneity in plaza and domestic architecture suggests that this tripartite structure did not foster social inequality (Nielsen 2008: 225). Whether or not symmetrical power was an ideological projection or political actuality, ‘remembering’ during the Regional Development Period involved the “invention of tradition” (sensu Hobsbawm and Ranger 1992) that tied ancestors to a timeless social order (Nielsen 2008: 226; see also Salomon 1995). In contrast, the selective destruction of ancestor monuments by the



Inka is interpreted as a “forgetting campaign” integral to the establishment of new power relations.

Although the spatial, social, and political dimensions of Colca Valley and Lipez cases are quite distinct (e.g., in the former, there is no evidence of the intentional dismantling or destruction of tombs in antiquity), both show how *localistic* research can approach the politics and temporality of above-ground burial on their own terms, without overreliance on ethnohistoric interpretation or functionalist models. The social norms that shaped inclusion in open sepulchers were not immutable. A more complete understanding of LIP mortuary politics must reconcile the remarkable diversity of *chullpa* traditions with the widespread phenomenon of ‘bringing out the dead’ in the wake of social crisis and political transformation. When we use theory to map mortuary practice onto other key features of the LIP political landscape, such as inter-group conflict and political segmentation, we risk reducing *chullpas* to ‘function’ when perhaps we should approach them as process, exploring their changing social correlates and meanings across time and space.

### Contributions and Future Directions

This dissertation makes important contributions to the study of mortuary politics and ethnogenesis by illustrating how the active construction of social identities in life and death can exist in tension with one another. It addresses often overlooked themes in the bioarchaeology of ethnogenesis research—the formation of dominant identities and the intersection of ethnicity and gender (see Voss 2015)—by arguing that the embodiment of a Collagua ethnic identity reconfigured gender relations and elevated the status of modified females in the local political economy. Nevertheless, “ethnic” identity in the Colca Valley remained deeply embedded, rather

than set apart from, local kinship organization and long-standing mortuary tradition. The case of the Collaguas challenges traditional models where ethnic identities are constructed in opposition (“us” versus “them”). By focusing on boundary formation processes at a single locale across time, the study reveals how traditional portrayals of mortuary territoriality and ethnic factionalism during the LIP mask significant microscale social diversity, otherwise accessible through a bioarchaeological approach. Understanding the lived experience of such diversity, its real effects on the body and implications for relationships of power, can provide important insights into the negotiated encounter between local *ayllus* and the Inka state.

Future research will situate ethnogenesis in the Colca Valley within the broader regional dynamics of conflict and migration during the late prehispanic era. On-going analyses of trauma and morbidity data from human skeletal remains will address how the embodiment of ethnic identity shaped experiences of health and violence at a time of heightened hostility. Multi-regional biodistance analysis and strontium isotope analysis of geographic origin will also clarify whether or not foreigners were incorporated into local society, as suggested by mytho-historical narratives of Collagua diaspora and marriage alliance. By exploring the complex relationships between community structure, ethnic diversity, and inter-group antagonism, this research will continue to shed light on the so-called “dark ages” of Andean prehistory.

In conclusion, the politics of above-ground burial in the Colca Valley worked to mask profound social transformations during the Late Intermediate Period that directly impacted the lived experiences of the region’s inhabitants. The intentional marking of a Collagua identity on the body may have promoted intra-community cohesion, but it also likely ascribed special rights and privileges to modified individuals, resulting in widening social differences, especially among

females. Shared mortuary practices effectively normalized these emergent inequalities through an ideology of unchanging tradition.

## APPENDIX A: ARCHAEOLOGICAL CONTEXT OF RADIOCARBON DATES

A total of 15 radiocarbon dates (8 bone, 7 botanical) were run on materials recovered by Proyecto Bio-Arqueológico Coporaque. Eight samples of human bone derive exclusively from crania, and in all cases, the skeletal elements sampled were the vomer, nasal septum, and/or inferior nasal conchae. Plant organics from wall mortar were also analyzed to date the construction of funerary chambers. Botanical inclusions, such as grass and straw, were extracted using sterilized dental tools and tweezers. Generally, these plant materials should yield reliable dates since they are small and short-lived (D. Hood, Beta Analytic, personal communication). Care was taken to remove or avoid modern root material. All samples for radiocarbon dating were exported to the United States under permit from the Peruvian Ministry of Culture (RVM No. 077-2014), and then shipped to DirectAMS for high-precision radiocarbon dating.

All calibrated ages are presented in Table A.1, and the archaeological context of each sample is summarized below. The sample no. for each specimen (e.g., C98-1051/26/1) indicates provenience by site ('C98'), locus ('1051'), bag ('/26'), and sub-bag (/1), which resulted when the contents of a sample were sub-divided for export. For complete summaries of individual loci, as well a description of the locus numbering system, the reader is referred to Ferrando Verástegui and Velasco (2014). Dates reported in text are calibrated to 2-sigma ranges using OxCal v.4.2 and the ShCal13 radiocarbon calibration curve for the Southern Hemisphere (Hogg, et al. 2013). The probability distributions of radiocarbon dates are also represented graphically and ordered chronologically in Figure A.1, to illustrate how they broadly cluster into the Early LIP (A.D. 1150-1300) and Late LIP (A.D. 1300-1450).

Table A.1. Radiocarbon dates, ordered by archaeological context.

Lab Code	Site	Chamber	Sample No.	Context	Material	$\delta^{13}\text{C}$	$^{14}\text{C}$ age (B.P.)	1 $\sigma$ cal date (AD)	2 $\sigma$ cal date (AD)
D-AMS 008518	CO-098	003	C98-1051/26/1	excavation	bone	-9.7	548 $\pm$ 20	1412-1434	1404-1442
D-AMS 008509	CO-098	005	C98-3005/4/2	wall mortar	botanical	-19.8	<b>634 <math>\pm</math> 24</b>	1321-1400	1310-1410
D-AMS 008510	CO-098	008	C98-3008/1/1	wall mortar	botanical	-21.5	<b>757 <math>\pm</math> 23</b>	1274-1297	1235-1381
D-AMS 008511	CO-098	015	C98-3015/5	wall mortar	botanical	-21.1	<b>584 <math>\pm</math> 21</b>	1398-1418	1327-1435
D-AMS 008512	CO-098	022	C98-3022/1	wall plaster	botanical	-16.3	<b>850 <math>\pm</math> 22</b>	1216-1266	1200-1274
D-AMS 008513	CO-098	024 (027)	C98-3024/1/1	wall plaster	botanical	-13.0	554 $\pm$ 25	1409-1432	1400-1443
D-AMS 008516	CO-098	028	C98-1028/2/1	excavation	bone	-10.2	868 $\pm$ 21	1190-1261	1180-1268
D-AMS 008514			C98-3028/1/1	wall mortar	botanical	-10.7	931 $\pm$ 25	1150-1206	1046-1219
D-AMS 008519	CO-098	035	C98-1080/14/1	surface	bone	-10.2	642 $\pm$ 20	1321-1397	1311-1404
D-AMS 008520			C98-1081/83/1	excavation	bone	-8.1	654 $\pm$ 23	1318-1394	1301-1400
D-AMS 008517	CO-098	051	C98-1033/9/1	excavation	bone	-11.9	808 $\pm$ 20	1230-1278	1225-1281
D-AMS 008515			C98-3051/1	wall mortar	botanical	-26.7	796 $\pm$ 28	1230-1284	1222-1291
D-AMS 008521	CO-098	054	C98-1058/5/1	surface	bone	-10.0	784 $\pm$ 23	1235-1289	1226-1294
D-AMS 008522	CO-118	--	C118-2000/4/1	surface	bone	-6.8	874 $\pm$ 20	1185-1227	1177-1266
D-AMS 008523		--	C118-2011/11/1	excavation	bone	-6.4	812 $\pm$ 21	1230-1276	1223-1281

Dates in **bold** pertain to chambers that were not excavated.

Yuraq Qaqa (CO-098)

*Chamber 003, 005, 008*

Chambers 003-008 form a cluster of semi-circular chambers that were built in succession at the southern extent of the primary concentration at Yuraq Qaqa. Based on wall abutment patterns, funerary chambers in this area were built in the following order:

008>006>004>003/007>005. Thus, radiocarbon dates for Chamber 008 and 005 should represent “early” and “late” bookends for construction in this area of the site. The radiocarbon date for Chamber 003 is expected to be intermediate to these two dates.

In fact, the first radiocarbon date from Chamber 003 (C98-1051/26/1) produces one of the latest dates at Yuraq Qaqa (cal A.D. 1404-1442). The sample derives from the cranium of a young adult female with oblique rounded modification. The cranium was located approximately 10 cm below surface deposits in the southwest quadrant of the structure.

The second radiocarbon date (C98-3005/4/2) comes from a small piece of wood in the wall mortar of Chamber 005, which abuts Chamber 003 to the northeast. It yields a calibrated date of A.D. 1310-1410. The 2-sigma range largely falls before the bone date associated with Chamber 003 (described above), yet Chamber 005 necessarily postdates Chamber 003 in construction. There are a few possible reasons for this discrepancy. First, the cranium sampled from Chamber 003 may have been a later burial added to a chamber that had been built generations earlier. Alternatively, given that the cranium was located near the surface, it may have been displaced from an adjacent tomb into Chamber 003 by looters. (In fact, Chamber 005 is largely bereft of human remains.) Yet if this were the case, it still does not explain why the bone date considerably postdates the construction of Chamber 005. A final possibility is that the

radiocarbon age from Chamber 005 suffers from an “old wood” problem, and it was actually built much later in the 15<sup>th</sup> century.

The third radiocarbon date (C98-3008/1/1) comes from a botanical fragment extracted from the mortar of the north wall of Chamber 008, which is a “primal structure,” and therefore represents an early-phase construction in this sector of the site. The sample yields a 2-sigma range of cal A.D. 1235-1381. Notably, the 1-sigma range (cal A.D. 1274-1297) predates the 1-sigma range of Chamber 005 (cal A.D. 1321-1400), which is consistent with the architectural sequence.

#### *Chamber 015*

The fourth radiocarbon date (C98-3015/5) comes from a botanical inclusion in the interior wall mortar from Chamber 015, which was one of the last structures built in the primary concentration of *chullpas* at Yuraq Qaqa, as inferred from the architectural sequence. It yields a date of cal A.D. 1327-1435, which is consistent with that observation. The sample was firmly embedded in the mortar matrix and needed to be pried out with a sterilized dental tool. Thus, there is little doubt the date reflects the actual construction event.

#### *Chamber 022, 024, 027*

The fifth radiocarbon date (C98-3022/1) comes from a botanical fragment extracted from remnants of plaster on the east wall/façade of Chamber 022. This chamber is a “primal structure,” and the radiocarbon date it yields (cal A.D. 1200-1274) is one of the earliest at Yuraq Qaqa. The chamber is essentially hidden from view by subsequent construction, and in fact, partly forms the back wall of Chamber 024, which appropriates its cornice as structural support

for a stone slab roof. This abutment pattern protects Chamber 022 from direct sunlight, which allowed for the preservation of plaster and paint.

The sixth radiocarbon date (C98-3024/1/1) comes from a large botanical fragment extracted from wall plaster on the exterior surface of the north wall of Chamber 024. It yields a 2-sigma range of cal A.D. 1400-1443, suggesting it was constructed over a century after Chamber 022, which, as described above, serves as architectural support. Together, these two dates from architecturally-related chambers in close proximity to one another provide strong empirical evidence for the long-term “morphogenetic development” of the site (Velasco 2014). The radiocarbon age derived for Chamber 024 is also important because it indirectly dates the human remains excavated from Chamber 027. This is because Chamber 024 serves as an interior wall of Chamber 027, which abuts it to the north. Using sample C98-3024/1/1 as *terminus post quem* for subsequent construction places Chamber 027 and its associated archaeological materials in the latter half of the LIP (A.D. 1300-1450).

### *Chamber 028*

The seventh (C98-1028/2/1) and eighth (C98-3028/1/1) radiocarbon dates represent bone and mortar dates for Chamber 028, a primal structure located below Chamber 027. The bone date (C98-1028/2/1) derives from the unmodified cranium of a young adult female. It produces a radiocarbon age of cal A.D. 1180-1268. The mortar date (C98-3028/1/1) comes from the interior surface of the east wall and represents the earliest date for funerary construction at Yuraq Qaqa: cal A.D. 1046-1219. As expected, these dates overlap with other another and provide strong evidence for assigning the human remains excavated from locus 1028 to the Early LIP (A.D. 1150-1300).



The possibility of admixture between Chambers 027 and Chamber 028 must be addressed, since they represent the only archaeological contexts that were excavated within the same unit (but as separate loci). Chamber 028 was not initially visible because of architectural collapse. The first two excavation loci of Chamber 027 (1025, 1026) include commingled skeletal elements, located on the surface and in loose soil immediately below the surface that was mixed with grass, branches, leaves, and animal excrement. At the base of locus 1026, remnants of the east wall of Chamber 028 were first identified. Exterior to this wall (i.e. to the east), we reached a layer of loose medium-size gravel that continues below the outer wall of Chamber 027 and defines its constructive base (see Velasco 2014: Fig. 4). The human remains located above this makeshift chamber floor are included in the Chamber 027 burial group.

The soil matrix of the first excavation locus of Chamber 028 (locus 1027) was similar to that of locus 1026, showing clear evidence of disturbance based on grass and coprolite inclusions. Because of postmortem disturbance and the destruction of the original roof of Chamber 028, it cannot be determined if human remains from locus 1027 were originally deposited in Chamber 027 or 028. These remains include two crania analyzed in the present study, but excluded from all temporal comparisons (i.e., Early LIP vs. Late LIP). In contrast to 1027, locus 1028 represents a clear change in the color, texture, and inclusions of the soil matrix (Ferrando Verástegui and Velasco 2014: 37). There also exist taphonomic differences between the human skeletal remains from 1027 and 1028 with respect to coloration and preservation. Without a doubt, the soil matrix still presents characteristics of disturbance, but some human skeletal elements were partially articulated and a nearly intact *capullo* (mummy bundle) was discovered—a rare find at the site suggesting that its presence was unknown to the looters who ransacked Chamber 027.

In its totality, locus 1028 is interpreted as a distinct cultural deposit that was disturbed by an earlier episode of looting (Ferrando Verástegui and Velasco 2014). Human remains from loci 1025/1026 (assigned to the Late LIP) and locus 1028 (assigned to the Early LIP) are approximately separated by a minimum of 20-30 cm of excavated soil matrix. In all, the contextual evidence combined with concordant dates from bone and mortar for Chamber 028 justify its temporal separation from the Chamber 027 burial group.

### *Chamber 035*

The ninth (C98-1080/14/2/1) and tenth (C98-1081/83/1) radiocarbon dates come from two crania recovered from Chamber 035, the largest funerary chamber at Yuraq Qaqa. One of the radiocarbon samples was selected from an unmodified female cranium collected on the surface of the unit, while the other (C98-1081/83) was selected from a modified male cranium excavated from the dense conglomeration of skeletal remains, textiles, and vegetal fibers that characterizes the primary excavation locus (1081). Their associated age ranges are largely overlapping (cal A.D. 1311-1404 and cal A.D. 1301-1400. respectively), chronologically placing use of the funerary structure in the Late LIP (A.D. 1300-1450). No organic samples were collected from the wall mortar of this funerary structure. This is because water seepage from rainfall has eroded mortar, and observable botanical remains appeared to be modern roots. Consequently, funerary construction has not been directly dated.

Due to the large MNI recovered from Chamber 035, the commingling of human remains from adjacent chambers must be considered a possibility. Chamber 035 was built above an earlier funerary structure (Chamber 036), whose roof was destroyed during looting. In addition, remnants of stone and mortar inserted into the bedrock 1.20 m above Chamber 035 present the

possibility that a funerary structure once existed above it, but this was inconclusive. In either event, there is no direct evidence for the mixing of temporal contexts. As stated above, both dates from human bone fall squarely in the 14<sup>th</sup> century. The concordant radiocarbon date from the surface-collected cranium, which was more likely to represent an individual displaced into the tomb by looting, reinforces the temporal integrity of this burial group.

#### *Chamber 051*

The eleventh radiocarbon date (C98-1033/9/1) comes from an unmodified male cranium excavated from locus 1033 of Chamber 051. It yields a 2-sigma age range of cal A.D. 1225-1281. The cranium was located approximately 20 cm below the surface of the unit.

The twelfth radiocarbon date (C98-3051/1) was run on a botanical inclusion from the north wall of Chamber 051. The sample was difficult to remove from the mortar, leaving no doubt it was part of the mortar matrix. This radiocarbon date places construction of Chamber 051 between cal A.D. 1222-1291. In sum, the dates for bone and mortar, as a proxy for the use and construction of the tomb, are concordant and fall before A.D. 1300 with 94.5% probability.

#### *Chamber 054*

The thirteenth radiocarbon date (C98-1058/5/1) comes from an unmodified male cranium collected from the surface of Chamber 051. It yields a radiocarbon age of cal A.D. 1226-1294. Although botanical samples were collected from wall mortar of Chamber 051, no dates were run because of the large amount of modern root and plant growth intruding into the chamber.

## Sahuara (CO-118)

The fourteenth (C118-2000/4/1) and fifteenth (C118-2011/11/1) radiocarbon dates come from two crania located in distinct stratigraphic loci in the burial cave at Sahuara (CO-118). C118-2000/4/1 represents a male cranium with tabular erect modification, which was one of 19 crania clustered near the looter's entrance into the burial chamber. It yields a 2-sigma age range of cal A.D. 1177-1266. In addition to this date from a surface-collected specimen, another date was run on human bone from a cranium located farther into the chamber and approximately 25 cm below the initial surface of the unit. This sample represents an unmodified male cranium and yields an age range that is only slightly later (cal A.D. 1223-1281). Together, these radiocarbon dates place the use of the funerary structures at Sahuara squarely in the 13<sup>th</sup> century. These early dates are in agreement with Wernke's (2003) assessment that the site lacks a Late Horizon component.

## Summary

In general, radiocarbon dates from chambers at Yuraq Qaqa are concordant with the architectural sequence of the site. The only radiocarbon date that could be considered problematic is the mortar date for Chamber 005, which was older than the bone date associated with Chamber 003. However, because these dates are from different materials, they are not directly comparable. Possible explanations for the discrepancy were put forth, including the old wood effect. Regardless, both dates fall within the Late LIP (A.D. 1300-1450).

In all cases where multiple dates were run for a single mortuary context (Chambers 028, 035, 051 at Yuraq Qaqa, and Sahuara), the resulting radiocarbon age ranges overlap considerably. The concordance of multiple dates within single chambers suggest that looting did

not result in the admixture of crania from different time periods. Funerary structures may have been used for multiple generations, but they do not appear to have been used over multiple centuries.

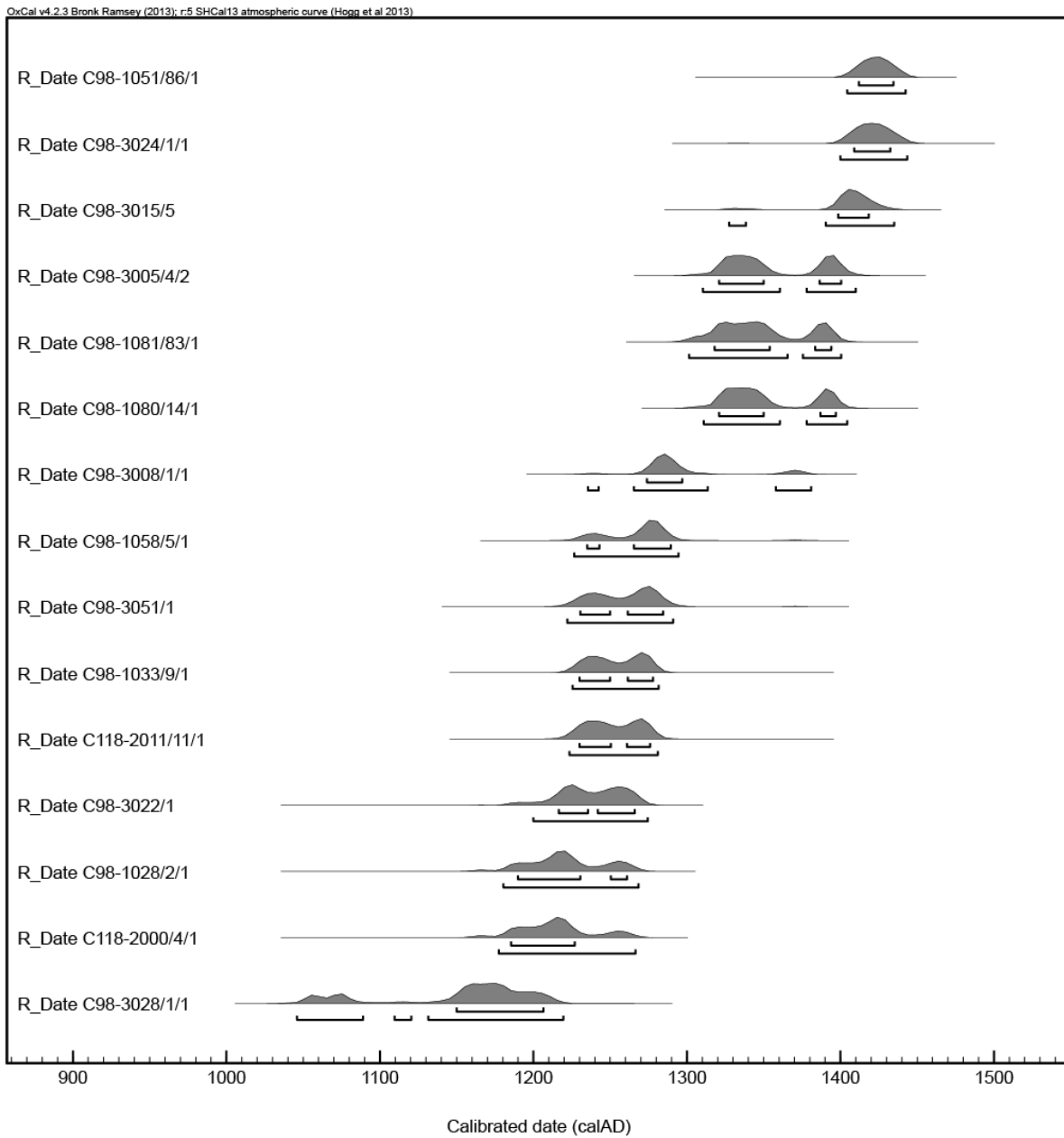


Figure A.1. Probability distributions of radiocarbon dates from Yuraq Qaqa (CO-098) and Sahuara (CO-118). Plot generated by OxCal 4.2.

APPENDIX B: DEMOGRAPHIC SUMMARY

**SITE \* AgeCategory Crosstabulation**

Count

SITE	AgeCategory														Total
	F	F/I	I	I/C	C	C/T	T	T/YA	YA	YA /MA	MA	MA /OA	OA	A	
CO-098	1	1	11	4	15	6	5	0	24	8	35	19	16	3	148
CO-118	0	0	15	1	11	1	4	2	15	7	17	7	3	0	83
Total	1	1	26	5	26	7	9	2	39	15	52	26	19	3	231

**SITE \* Sex Crosstabulation**

Count

SITE	Sex					Total
	?	F	F?	M	M?	
CO-098	7	41	12	29	16	105
CO-118	7	20	6	13	5	51
Total	14	61	18	42	21	156

## APPENDIX C: DATA COLLECTION PROTOCOLS

### Cranial Vault Modification Coding

(Based on Blom 1999: 199)

#### **CVM present:**

0 = absent  
1 = present  
1? = ambiguous

#### **General category:**

'Unmodified / Unintentional'  
'Erect'  
'Oblique'  
'Slight'

#### **Degree of Modification:**

0 = None  
1 = Slight      3 = Prominent  
2 = Moderate   4 = Excessive

#### **FRONTAL**

##### **FRO\_shape:**

0 = modification absent  
1 = frontal curved  
2 = frontal flat  
3 = frontal depressed  
(1-3 = modification present)

##### **FRO\_position (i.e., center of compression):**

1 = above bosses  
2 = mid-frontal  
3 = inferior, near or below bosses

##### **FRO\_orientation:**

0 = no impressions  
1 = 1 "pad" (midline)  
2 = 2 "pads" (symmetrically lateral to midline)  
3 = other (describe)

##### **Pre-bregmatic eminence:**

0 = absent  
1 = slight  
2 = marked

##### **Post-coronal constriction:**

0 = absent  
1 = slight  
2 = marked

#### **PARIETAL**

##### **PAR\_depression:**

0 = absent  
1 = slight  
2 = marked

##### **PAR\_impression:**

0 = absent  
1.1 = slight, asymmetrical  
1.2 = slight, bilateral  
2.1 = marked asymmetrical  
2.2 = marked, bilateral

#### **OCCIPITAL**

##### **OCC\_shape:**

0 = modification absent  
1 = occipital curved  
2 = occipital flat  
3 = occipital depressed  
(1-3 = modification present)

##### **OCC\_position (i.e., center of compression):**

1 = superiorinion  
2 = inion  
3 = inferiorinion

##### **OCC\_orientation**

0 = no impressions  
1 = horizontal impression  
2 = vertical impression  
3 = 1 & 2  
4 = extensive impressions

#### **LAMBDA / OBELION**

##### **L\_depression:**

0 = absent  
1 = slight  
2 = marked

##### **L\_impression:**

0 = absent  
1? = indirect compression  
1 = slight impression/flattening  
2 = marked flattening  
3 = pronounced, extending to the parietals  
2 = marked

##### **Ob\_Imprs**

0 = absent  
1 = midline  
2 = bilateral

\*For all fields:  
9 = not observable

### Cranial Non-Metric Scoring Rubric

No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
1	Metopic suture	0 = absent	0	Buikstra & Ubelaker (1994)	p. 41-46	
		1 = partial	1			
		2 = complete				
		9 = unobservable	9			
2	Suprorbital foramen	0 = absent	0	Buikstra & Ubelaker (1994)	p. 50-55	Openings must trace to the orbital surface to be counted as present.
		1 = present	1			
		2 = multiple foramina				
		9 = unobservable	9			
3	Supraorbital notch	0 = absent	0	Buikstra & Ubelaker (1994)	p. 50-55	“Present” includes blurred notches.
		1 = present, <1/2 occluded	1			
		2 = present, >1/2 occluded				
		3 = present, occlusion unknown				
		4 = multiple notches				
		9 = unobservable	9			
4	Supratrochlear foramen	0 = absent	0	Blom (1999)	p. 50-55	Openings must trace to the orbital surface to be counted as present.
		1 = present	1			
		9 = unobservable	9			
5	Supratrochlear notch	0 = absent	0			Grooves at the confluence of the horizontal and vertical aspects of the orbit that are not well marked (“blurred” or “slight”) are not considered present.
		1 = present	1			
		9 = unobservable	9			
6	Infraorbital suture	0 = absent	0	Buikstra & Ubelaker (1994)	p. 67-69	Only persistence of facial part of the suture considered. The infraorbital suture is considered “complete” if it connects with either the primary or secondary infraorbital foramen.
		1 = partial				
		2 = complete	1			
		9 = unobservable	9			
7	Multiple infraorbital foramina	0 = absent	0	Buikstra & Ubelaker (1994)	p. 70-74	Two distinct canals, as well as two external orifices that share a common canal, are considered positive expressions of the trait. Accessory foramina were probed with 0.3mm nylon or brush filament to prove communication with the inner orifice of the infraorbital canal. False foramina not counted.
		1 = internal division only				
		2 = two distinct foramina	1			
		3 = more than two distinct foramina				
		9 = unobservable	9			



No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
8	Anterior ethmoid foramen exsutural	0 = absent	0	Hauser & DeStefano (1989)	p. 58-60	Anterior ethmoid foramen is defined as “the first [foramen] encountered in an anterior-posterior direction,” following Hauser & DeStefano (1989: 59).
		1 = sutural				
		2 = exsutural	1			
		3 = unknown (suture obliterated)	9			
		9 = unobservable				
9	Posterior ethmoid foramen absent	0 = absent	0	Hauser & DeStefano (1989)	p. 58-60	
		1 = 1	1			
		2 = 2				
		3 = 3 or more				
		9 = unobservable	9			
10a	Zygomaxillary tuberosity (Location)	0 = absent	NA	Hauser & DeStefano (1989)	p. 74-77	Only projections that meet or exceed 2mm threshold counted as present (see Nikita et al. 2012). Location not considered in dichotomization of trait.
		1 = sutural				
		2 = maxillary				
		3 = zygomatic				
		9 = unobservable				
10b	Zygomaxillary tuberosity (Degree)	0 = absent	0	Hauser & DeStefano (1989)	p. 74-77	
		1 = trace (<2mm)				
		2 = medium (2-4mm)	1			
		3 = strong (>4mm)				
		9 = unobservable	9			
11	Marginal tubercle	0 = absent	0	Hauser & DeStefano (1989)	p. 226-229	Only projections equal to or greater than 4mm counted as present (Nikita et al. 2012).
		1 = trace (<4mm)				
		2 = medium (4-7mm)	1			
		3 = strong (>7mm)				
		9 = unobservable	9			
12	Multiple zygomatico-facial foramina	0 = absent	0	Buikstra & Ubelaker (1994)	p. 224-225	Following Torres-Rouff et al. (2013), “Two or more foramina must be complete and unobstructed.” Because of the preponderance of false foramina, zygomatico-facial foramina that could not be traced <u>completely</u> to the inner orbit are not counted. Foramina that may have been obstructed by soil
		1 = 1 large				
		2 = 1 large + smaller f.	1			
		3 = 2 large				
		4 = 2 large + smaller f.				
		5 = 1 small	0			
	6 = multiple small	1				

No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
		9 = unobservable	9			compaction (or other taphonomic factors) were coded "unobservable" to be conservative.
13	Os Japon	0 = absent	0	Hauser & DeStefano (1989)	p. 222-224	Partial division is defined as 2-10mm (Hauser and DeStefano 1989: 223, Ossenber 1970).
		1 = partial division	1			
		2 = bipartite				
		3 = multipartite				
		9 = unobservable	9			
14	Fronto-temporal articulation	0 = absent	0	Hauser & DeStefano (1989)	p. 216-219	Incomplete articulation not considered because character states defined as "incomplete" (e.g., "reduced length of sphenoparietal suture") are less discrete (Hauser and DeStefano 1989: 216).
		1 = complete articulation	1			
		2 = incomplete articulation	0			
		9 = unobservable	9			
15	Epipteric bone	0 = absent	0	Buikstra & Ubelaker (1994)	p. 210	Only ossicles that completely articulated with the frontal, parietal, sphenoid and temporal bones considered present.
		1 = present	1			
		9 = unobservable	9			
16	Auditory torus	0 = absent	0	Buikstra & Ubelaker (1994)	p. 186-187	
		1 = <1/3 canal occluded				
		2 = 1/3-2/3 canal occluded	1			
		3 = > 2/3 canal occluded				
		9 = unobservable	9			
17a	Mastoid foramen (Location)	0 = absent	NA	Buikstra & Ubelaker (1994)	p. 201-205	Mastoid foramen location not presently considered in dichotomized data tabulation.
		1 = temporal				
		2 = sutural				
		3 = occipital				
		4 = both sut & temp				
		5 = both occ & temp				
		9 = unobservable				
17b	Mastoid Foramen (Number)	0 = absent	0	Buikstra & Ubelaker (1994)	p. 201-205	Multiple foramina, regardless of position, are scored as present, following dichotomization protocol of Pink (2013). Accessory foramina were probed to confirm communication with the sigmoid sulcus. Openings for which passage into endocranium was ambiguous were not considered present.
		1 = 1				
		2 = 2	1			
		3 = >2				
		9 = unobservable	9			
18		0 = absent	0		p. 206-207	
		1 = trace (1/5-1/3)				

No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
	Squamomastoid suture	2 = partial (1/3-3/4)	1	Buikstra & Ubelaker (1994)		
		3 = complete (>3/4)				
		9 = unobservable	9			
19	Parietal notch bone	0 = absent	0	Buikstra & Ubelaker (1994)	p. 207-210	Only discrete ossicles equal to or greater than 5mm in their largest diameter considered present.
		1 = present	1			
		9 = unobservable	9			
20	Asteronic bone	0 = absent	0	Buikstra & Ubelaker (1994)	p. 196-199	Scored present if clearly discernible regardless of size or partial obliteration.
		1 = present	1			
		9 = unobservable	9			
21	Ossicle at occipito-mastoid suture	0 = absent	0	Buikstra & Ubelaker (1994)	p. 196-199	Scored present if clearly discernible regardless of size or partial obliteration. If <1/2 of suture observable, coded "unobservable."
		1 = present	1			
		9 = unobservable	9			
22	Parietal foramen	0 = absent	0	Buikstra & Ubelaker (1994)	p. 78	Scored present "irrespective of position, size or number" (Nikita et al. 2012: 283). Minute blind (not patent) foramina are considered absent.
		1 = present, on parietal	1			
		2 = present, sutural				
		9 = unobservable	9			
23	Coronal ossicles	0 = absent	0	Buikstra & Ubelaker (1994)	p. 84-88	Only discrete ossicles equal to or greater than 5mm in their largest diameter considered present. Scored present if clearly discernible in spite of partial obliteration. For coronal, sagittal, and lambdoidal ossicles, if <1/2 of suture observable, trait coded "unobservable."
		1 = present	1			
		9 = unobservable	9			
24	Ossicle at bregma	0 = absent	0	Buikstra & Ubelaker (1994)	p. 84	
		1 = present	1			
		9 = unobservable	9			
25	Sagittal ossicles	0 = absent	0	Buikstra & Ubelaker (1994)	p. 84	
		1 = present	1			
		9 = unobservable	9			
26	Apical bone	0 = absent	0	Buikstra & Ubelaker (1994)	p. 84	
		1 = present	1			
		9 = unobservable	9			
27	Lambdoidal ossicles	0 = absent	0	Buikstra & Ubelaker (1994)	p. 84	
		1 = present	1			
		9 = unobservable	9			
28	Inca bone	0 = absent	0	Buikstra & Ubelaker (1994)	p. 99	Scored present if clearly discernible in spite of partial obliteration.
		1 = complete, single	1			
		2 = bipartite				
		3 = tripartite				

No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
		4 = partial 9 = unobservable	9			
29	Occipital foramen	0 = absent 1 = present, @ inion 2 = present, near foramen magnum 9 = unobservable	0 1 9	Hauser & DeStefano (1989)	p. 112-114	Occipital foramina located at inion or near the posterior margin of the foramen magnum are counted present. All foramina were traced to prove communication with the cranial cavity and to distinguish true occipital foramina from nutrient foramina (Hauser and DeStefano 1989: 114).
30	Condylar canal patent	0 = not patent 1 = patent 9 = unobservable	0 1 9	Buikstra & Ubelaker (1994)	p. 114	
31	Condylar facet double (=divided occipital condyles)	0 = absent 1 = partial division 2 = complete division 9 = unobservable	0 1 9	Hauser & DeStefano (1989)	p. 116-118	
32	Paramastoid process	0 = absent 1 = small (<1mm) 2 = medium (1-3mm) 3 = strong (>3mm) 9 = unobservable	0 1 9	Hauser & DeStefano (1989)	p. 128-130	Because of variability in the morphology and placement (lateral or medial) of projections medial to the mastoid process and lateral to the occipital condyles, only well marked protuberances were counted present. Slight projections or elevated paramastoid regions <=3mm were not considered.
33a	Precondylar tubercle (Location)	0 = absent 1 = paired 2 = right only 3 = only left 4 = median 9 = unobservable	0 1 9	Hauser & DeStefano (1989)	p. 134-136	Because of variability in the morphology and location of tubercles and ridges near the anterior margin, only well marked tubercles >2mm “at the anterior, midline of the foramen magnum margin” were counted present, following definition and reference photograph in Osteoware Software Manual Volume II. These criteria for dichotomization mean that this trait actually records the presence or absence of the ossified apical ligament, rather than precondylar tubercle.
33b	Precondylar tubercle (Size)	0 = absent 1 = small (<2mm) 2 = medium (2-4mm) 3 = large (>4mm) 9 = unobservable	0 1 9	Hauser & DeStefano (1989)	p. 134-136	
34		0 = absent 1 = partial, internal surface	0		p. 120-124	Complete divisions with small fissures considered present.

No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
	Divided Hypoglossal Canal	2 = partial, w/in canal		Buikstra & Ubelaker (1994)		
		3 = complete, internal surface	1			
		4 = complete, w/in canal				
		9 = unobservable	9			
35	Foramen Ovale Incomplete	0 = absent	0	Buikstra & Ubelaker (1994)	p. 149-153	"Trace" expression (fissure) not counted as "partial" formation, according to illustrations in Hauser and DeStefano (1989).
		1 = partial formation	1			
		2 = no definition of foramen				
		9 = unobservable	9			
36	Foramen Spinosum Incomplete	0 = absent	0	Buikstra & Ubelaker (1994)	p. 149-153	Because of considerable variability in the formation of the medial wall, morphological variants require further specification. In this study, "Absence" is defined as a complete (closed) foramen in the inferior aspect. A fissure or small foramen in the medial wall is counted as a "trace" expression and considered "absent" in the dichotomous scoring system. The following character states are considered "partial formation" (a) slight dehiscence of inferior border of medial wall; (b) significant dehiscence of medial wall (>1/2 absent), but still closed in superior aspect; (iii) significant dehiscence, nearly closes with spicules or closed superiorly but fissure persists. "No definition of foramen" indicates that the medial wall is completely absent.
		1 = partial formation	1			
		2 = no definition of foramen				
		9 = unobservable	9			
37	Foramen of Vesalius	0 = absent	0	Hauser & DeStefano (1989)	p. 149-153	Foramen of Vesalius defined as accessory opening located antero-medial to foramen ovale. Because of porosity at base of pterygoid process, potential foramina were traced to prove passage into cranial cavity. Only patent foramen counted as present.
		1 = trace				
		2 = incomplete				
		3 = complete (circular)	1			
		4 = complete (slit)				
		9 = unobservable	9			
38	Pterygo-spinous bridge	0 = absent	0	Buikstra & Ubelaker (1994)	p. 156	Partial formation defined as "the elongation of spines from both ends" (Hauser and DeStefano 1989: 156). I follow the dichotomization protocol of Pink (2013) who counts partial expression as present.
		1 = trace (spicule only)				
		2 = partial bridge	1			
		3 = complete bridge				
		9 = unobservable	9			

No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
39	Pterygo-alar bridge	0 = absent	0	Buikstra & Ubelaker (1994)	p. 156	See comment for pterygo-spinous bridge.
		1 = trace (spicule only)				
		2 = partial bridge	1			
		3 = complete bridge				
		9 = unobservable				
40	Tympanic Dehiscence	0 = absent	0	Hauser & DeStefano (1989)	p. 143-144	Includes any clear dehiscence of tympanic plate, excluding pinpoint foramina (trace expression) and perforations at or near the lateral margin (atypical expression).
		1 = trace				
		2 = medium (foramen)	1			
		3 = strong				
		4 = excessive				
		9 = unobservable				
41	Accessory lesser palatine foramina	0 = absent	0	Hauser & DeStefano (1989)	p. 163-164	When more than one foramen present, trait is scored as present (Berry and Berry 1967). Multiple foramina are counted as such regardless of whether or not they ramify into a common or distinct canal. Thus, a large foramen with an internal division is counted as present. Because of variation in the position of lesser palatine foramina (see Hauser and DeStefano 1989: 164-165), the following conditions are stipulated: Perforations in the marginal crest are <u>not</u> counted as accessory foramina. Openings at or near the junction of the alveolar and pyramidal processes are only counted if clearly defined as foramina.
		1 = 1 foramen				
		2 = 2	1			
		3 = 3 or more				
		9 = unobservable				
42	Palatine torus	0 = absent	0	Hauser & DeStefano (1989)	p. 174-177	Following protocol of Pink (2013) and Nikita et al. (2012), weak expressions are dichotomized as present. In these cases, “the midline or the area beside it is slightly elevated either partially or completely” (Hauser and DeStefano 1989: 177).
		1 = trace	1			
		2 = medium				
		3 = strong				
		4 = excessive				
		9 = unobservable				
43	Maxillary torus	0 = absent	1	Hauser & DeStefano (1989)	p. 180-182	
		1 = small				
		2 = large				
		9 = unobservable				
44	Mental foramen	0 = absent	NA		p. 230-233	Excluded from analysis because of insufficient sample size.
		1 = 1				

No.	Trait	Original Scoring	Collapsed Scoring	Source	Hauser & DeStefano (1989)	Comments
		2 = 2 3 = >2 9 = unobservable		Buikstra & Ubelaker (1994)		
45	Mandibular torus	0 = absent 1 = trace 2 = moderate, 2-5mm 3 = marked, >5mm 9 = unobservable	NA	Buikstra & Ubelaker (1994)	p. 182-185	Excluded from analysis because of insufficient sample size.
46a	Mylohyoid bridge (Location)	0 = absent 1 = near mandibular foramen 2 = center of groove 3 = 1&2, with hiatus 4 = 1&2, no hiatus 9 = unobservable	NA	Buikstra & Ubelaker (1994)	p. 234-235	Excluded from analysis because of insufficient sample size.
46b	Mylohyoid bridge (Degree)	0 = absent 1 = partial 2 = complete 9 = unobservable	NA	Buikstra & Ubelaker (1994)	p. 234-235	

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