2009

Mysteries of the Dead: A Taphonomic Analysis of the Skeletal Remains from the Peruvian Highland Sites of Marcahuamachuco and Cerro Amaru

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Mysteries of the Dead: A Taphonomic Analysis of the Skeletal Remains from the Peruvian Highland Sites of Marcahuamachuco and Cerro Amaru

(Spine title: Marcahuamachuco and Cerro Amaru: Taphonomic Skeletal Analysis)

(Thesis format: Monograph)

by

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Graduate Program in Anthropology

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts

School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

THE UNIVERSITY OF WESTERN ONTARIO
SCHOOL OF GRADUATE AND POSTDOCTORAL STUDIES

CERTIFICATE OF EXAMINATION

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entitled:

Mysteries of the Dead: A Taphonomic Analysis of the Skeletal Remains from the Peruvian Highland Sites of Marcahuamachuco and Cerro Amaru

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Master of Arts

Date August 24, 2009

Dr. Randa Farah
Chair of the Thesis Examination Board

ABSTRACT

Key Words: Marcahuamachuco; Cerro Amaru; Taphonomy; Funerary Customs; Wall Burials; Mausoleum

This thesis examines the taphonomic changes on skeletal material recovered from the ancient sites of Marcahuamachuco and Cerro Amaru by the Huamachuco Archaeological Project in the 1980s. The remains were recovered from three different burial contexts: (1) Wall niches; (2) Underneath the Castillo; and (3) Inside a Mausoleum. The human skeletal samples recovered from inside the walls of niched halls at Marcahuamachuco are from males and females of average height, ranging in age from juvenile to older adult. Taphonomically, the remains exhibit evidence of extreme water damage, rodent gnawing and human modification consistent with burial preparation, mummification and possibly ancestor veneration. A young tall adult woman and a fetus were recovered from underneath the Castillo at Marcahuamachuco. The adult female exhibits evidence of post-mortem bone modification consistent with dismemberment. Given the taphonomy, context, and association with rich grave offerings, the burial appears to be a sacrificial offering. The skeletal material from inside the Mausoleum at Cerro Amaru was the most fragmentary and affected by non-cultural taphonomic processes. The remains are from males and females ranging in age from juvenile to older adult. Contextually, the Mausoleum contained the richest and most diverse grave goods, possibly indicative of a wealthy allyu or extended family burial plot. In general, the burial practices at Marcahuamachuco and Cerro Amaru are extremely diverse and multifaceted, reflecting the complexity of the society and the inhabitants who lived there.

ACKNOWLEDGEMENTS

My sincerest thanks to Drs. John and Theresa Topic, who allowed me to work on the material recovered from the Huamachuco Archaeological Project. Even though my short stay only allowed a portion of the skeletal remains to be analyzed, I hope that my work contributes to your understanding of the inhabitants of Marcahuamachuco and Cerro Amaru.

Thank you to the Social Sciences and Humanities Research Council for bestowing upon me a Canadian Graduate Scholarship, Award Number 766-2006-0346. Thanks also to the University of Western Ontario, Trent University and my parents for your patience and financial aid, without you this research would not have been possible.

My everlasting thanks to Dr. Tracy Rogers, Emily Holland, Christine Morgan, Jennifer Sharman, Hope Kron, Lisa Paulaharju, Tricia Fernandes and Josh Lewis for listening to me in my darkest hours. Thank you for all your wisdom, perspective and words of encouragement. Without you, I definitely would never have finished this thesis.

Last, but not certainly least, my deepest gratitude to Dr. Andrew Nelson. Our roads may have been long, bumpy and winding, but we have finally made it to the end. Thank you for not giving up on me, even when I made it difficult. Thank you for trusting this project with me. Peru will always be in my heart.

This thesis is dedicated to everyone who believed in me, even when I doubted myself. I am eternally grateful.

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CHAPTER 1: INTRODUCTION

The dead represent the past, and as such they are the authority of tradition when combined with the built environment and the activities it channels, bodies of the dead become powerful symbols presenting certain meanings.
Isbell 1997:15.

Introduction

The following thesis explores the taphonomic changes of a previously unstudied sample of human skeletal remains from the Peruvian highland sites of Marcahuamachuco and Cerro Amaru (See Figure 1.1 and 1.2). Although excavated in the 1980s, the human skeletal remains recovered from these two sites have not yet undergone a thorough examination or analysis. While some bones are preserved exceptionally well, most of the collection is commingled, highly fragmented and damaged by water. Since the skeletal remains excavated at the sites of Marcahuamachuco and Cerro Amaru were so heavily affected by taphonomy, they provide an excellent opportunity to better understand cultural and non-cultural processes that alter bone after death.

Taphonomy was first operationalized by Efremov (1940) as the study of the transition of death assemblages from the biosphere to the lithosphere. Bonnichsen (1989) further defined the term to include both the accumulation and modification of osteological material. In terms of this thesis, taphonomy refers to all the modifications the bone has undergone from the time of death of the individual to the time of analysis (Haglund and Sorg 2002). These alterations to the bone can range from damage via water and rodent gnawing to disarticulation and human intervention. To determine the different types and varieties of post-mortem bone modification, a thorough visual analysis was conducted. Two main taphonomic categories were established, distinguishing between non-cultural and cultural processes, i.e. environmental/climatic changes and intentional bone alterations, respectively.

Non-cultural taphonomic evidence dominates the entire Marcahuamachuco and Cerro Amaru collections. However, it is the less prevalent cultural taphonomic processes that are the most informative in regards to highland Peruvian burial practices during the Middle Horizon, approximately AD 600 to 1000. The main focus of this thesis is to elucidate the post-mortem treatment and preparation of human remains, the pattern and location of trauma and incised cut marks on the skeletal remains.

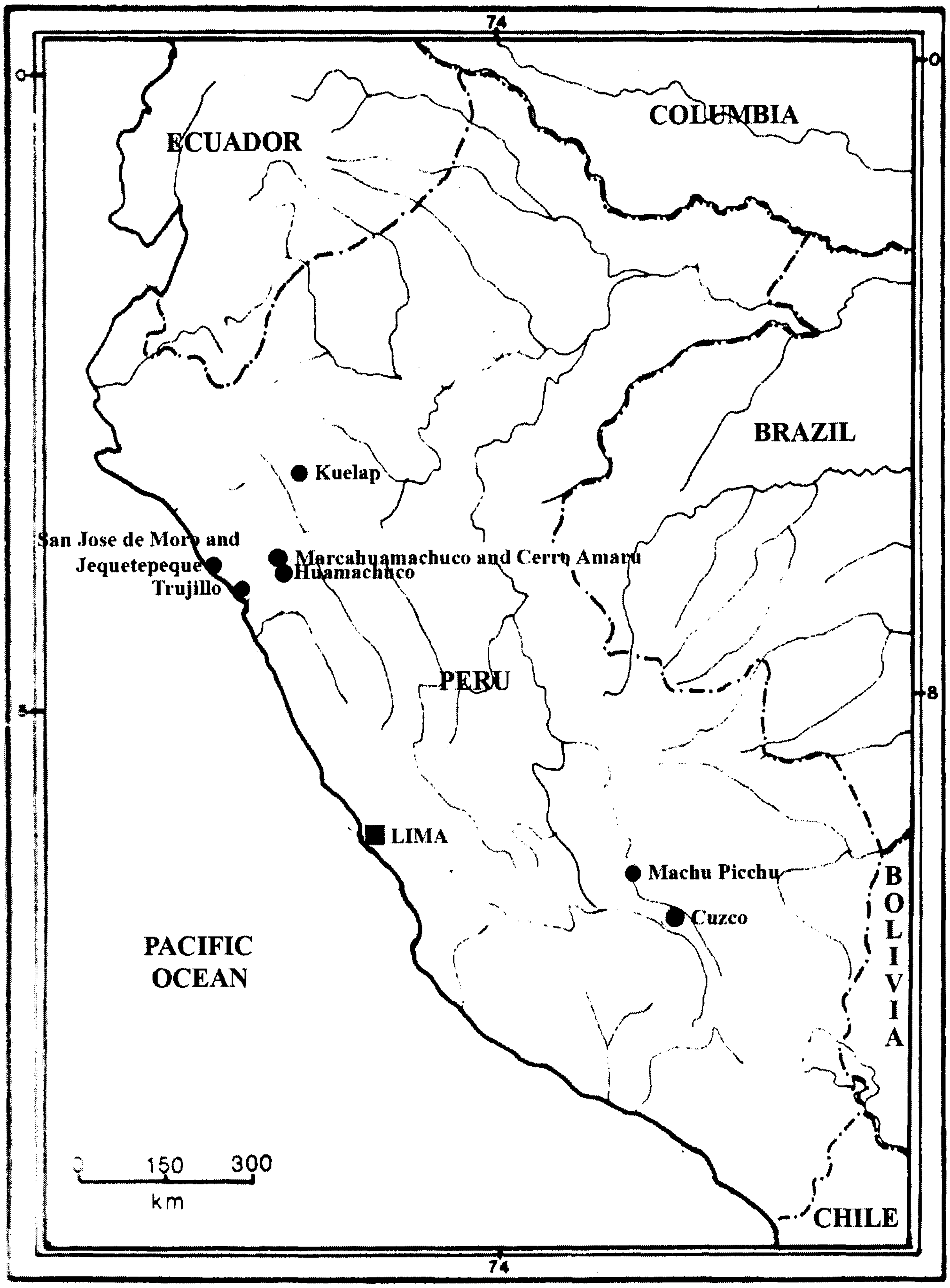

Figure 1.1: Map of Peru, showing the sites of Marcahuamachuco and Cerro Amaru in relation to major archaeological sites and modern cities.

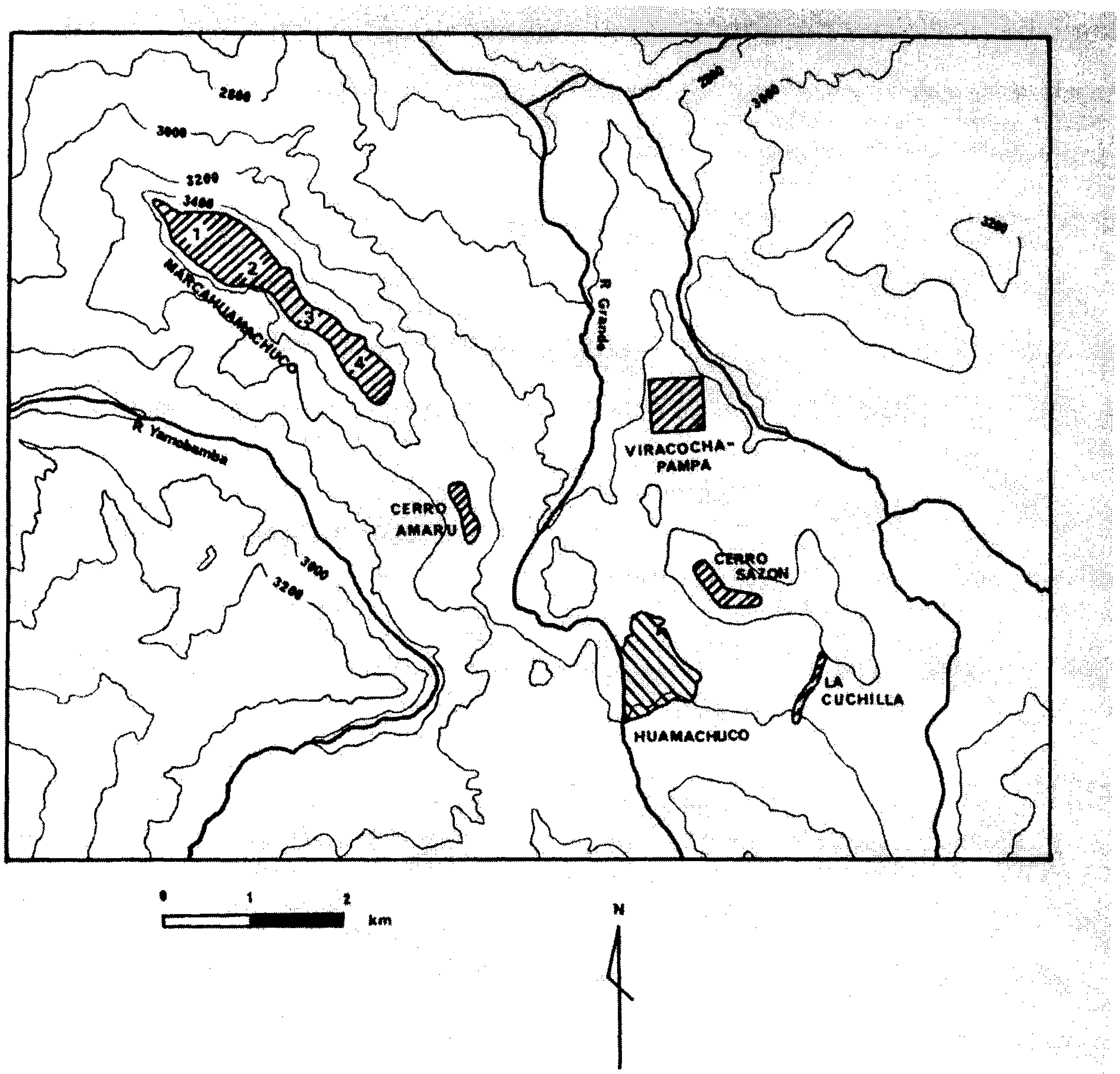

Figure 1.2: Map of the major sites surveyed and/or excavated during the Huamachuco Archaeological Project. The numbers refer to the sectors at Marcahuamachuco: (1) Cerro Viejo, (2) Cerro de los Corales, (3) Cerro de las Monjas, and (4) Cerro del Castillo (Topic 1991:142, Figure 1).

To better understand the taphonomic changes within the framework of the two sites, the numerous challenges faced in excavating and analyzing highland sites must be discussed. Sampling often plays a significant role in the quantity of osteological remains that are recovered. In the case of highland sites, the lack of osteological evidence is often not the result of sampling. Instead, one of the major problems plaguing recovery of human skeletal remains is the intensive looting of many Peruvian sites. Looting by *huaqueros* has resulted in many human burials have been displaced or destroyed. Very rarely has a tomb or burial been found intact and/or *in situ*. Thus, many scholars are forced to make inferences about funerary behaviour based on ethnohistoric data and/or information obtained from similar sites.

Another challenge faced by researchers is the poorly preserved organic material recovered at many of these highland sites. Preservation, or in this case lack thereof, is largely a result of the microclimate of the Cajamarca-Huamachuco Basin. Precipitation in the area results from the westerly warm air masses that come from the Amazon Basin. The result is a wet season that lasts from October to March (Geurts 1982; Shaughnessy 1984). In fact, up to 90% of the annual rainfall occurs during the rainy season (Shaughnessy 1984). In contrast, the months of April to September remain relatively dry and cold. The result is cracking, warping, and disintegration of bone, none of which are conducive to the preservation of organic and skeletal material.

The remoteness of these sites also poses a hurdle for researchers. Many coastal sites or well-known highland tourist destinations such as Machu Picchu can be accessed by the Pan-American Highway or by train. In contrast, most highland sites are only accessible via precipitous dirt roads, travelled only by the seasoned and determined traveller. For instance, the highland sites of Marcahuamachuco and Cerro Amaru require a day's drive up from the coastal city of Trujillo, along treacherous, largely unpaved, roads that wind around the mountains. The few stretches of road that are paved, are not maintained, resulting in numerous potholes and debris from the mountainsides. Also, visiting during the rainy season can be dangerous to one's health as numerous landslides and slippery roads are responsible for many lost lives, as witnessed by the mortuary shrines that litter the roadsides.

When the aforementioned obstacles are overcome, many of the final site reports have not incorporated a detailed osteological evaluation in conjunction with their findings and conclusions. Instead, when most highland sites were excavated and analyzed, scholars drew upon construction patterns and/or monumental architecture to determine the relationship between the groups who inhabited the sites and the use of these structures. Therefore, the goal of this thesis is to contribute to the overall understanding of the burial and mortuary customs practiced at Marcahuamachuco and Cerro Amaru through the integration of taphonomic, osteological and cultural data.

1.1 The Research Problem

The research presented here is based on the highly fragmented osteological and material remains recovered during several seasons of the Huamachuco Archaeological Project. The first field season, undertaken in 1981, began the long-term investigation into the prehistory of the Condebamba Basin of the north sierra of Peru, under the direction of Drs. John and Theresa Topic (1982:1)[1]. Although the Topics excavated and surveyed several sites in the Huamachuco area, only the skeletal remains from the sites of Marcahuamachuco and Cerro Amaru were analyzed for this thesis. The research goals are:

A. to analyze the human skeletal material to obtain valuable information about the individuals who were buried at Marcahuamachuco and Cerro Amaru.

B. to compare and contrast the relationships (if any) between three different burial contexts from the highland sites of Marcahuamachuco and Cerro Amaru: (1) Wall burials located in the galleries in Marcahuamachuco; (2) A deep single pit dug under the Castillo at Marcahuamachuco; and (3) Burials located within a mausoleum at Cerro Amaru.

C. to utilize taphonomic changes, namely human modification of the skeletal remains, to better understand the mortuary practices and post-mortem treatment of the ancient people who populated the two sites.

D. to determine whether evidence of cut marks and post-mortem processing of human remains, in conjunction with cultural material, may indicate that human sacrifice was practiced in the Condebamba Basin.

E. to use these findings as a guideline for other sites which contain similar mortuary architecture.

To ensure that the interpretations and analyses have a solid foundation, osteological findings will be incorporated with the cultural material recovered from the sites, in an attempt to better understand the occupation patterns and mortuary customs of the people who inhabited the sites of Marcahuamachuco and Cerro Amaru.

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[1] The research was funded and supported by the Social Sciences and Humanities Research Council (SSHRC) and Trent University. Permission for the archaeological fieldwork was provided by the Instituto Nacional de Cultura, Centro por Investigación y Restauración de Bienes Monumentales, Lima (Topic and Topic 1982:1)

1.2 Significance of Thesis

This thesis represents the first osteological and taphonomic analysis performed on the human skeletal remains from the highland sites of Marcahuamachuco and Cerro Amaru. To date, the studies conducted on these sites have relied heavily on the monumental architecture and the material remnants of the culture recovered from the archaeological record (e.g. Loten 1987; Thatcher 1972; J.Topic 1991; T.Topic 1991; Topic and Chiswell 1992). This thesis provides new data on the burial customs and rituals of the individuals living at Marcahuamachuco and Cerro Amaru, through the analysis of cultural versus non-cultural taphonomic changes found on human skeletal remains.

CHAPTER 2: LITERATURE REVIEW

Introduction

In order to put the archaeological sites of Marcahuamachuco and Cerro Amaru into a temporal and spatial context that is framed by previous studies, Peruvian archaeology and development are outlined, followed by a discussion of Andean chronology. The next section illuminates the sites of Marcahuamachuco and Cerro Amaru through archaeological information already obtained by the Huamachuco Archaeological Project. The available literature that pertains to analysis of ancient Peruvian skeletal material is briefly reviewed, focusing on highland sites. The subsequent section describes the current understanding of Peruvian burial practices. The last section of the chapter focuses on taphonomy, with an emphasis on cut marks as they pertain to mortuary ritual.

2.1 The Origin of Complex Societies in Peru

Andean civilization did not follow what scholars had believed were the logical steps and processes required to achieve a sedentary way of life. As Moseley (1975) first demonstrated, the widely accepted axiom that only an agricultural economy can support the foundations of civilization (e.g. Childe 1951, 1957; Wittfogel 1957) is inoperative in the case of coastal Andean cultural development. Since Peru occupies one of the driest land masses in the world, with only two percent of the land currently considered suitable for agriculture (Burger 1992), the ancient people had to rely on another subsistence pattern. The ancient Peruvians were initially able to achieve a state of sedentism through the exploitation and reliance on marine resources and they later developed systems of intensive agriculture. Hence, the Andean people have continually manipulated their environment for more than 6,000 years, making the current landscape a product of their intervention (Burger 1992).

Peru also breaks the classic model of development in the sense that the construction of monumental architecture predates ceramics. Peru's earliest monumental architecture is actually contemporaneous with the ziggurats built by the Sumerians in Mesopotamia and the ancient royal pyramids of the Old Kingdom in Egypt (Burger 1992). As hard as it was for some scholars to fathom that ancient Peruvians were able to exploit and manipulate their environment, it is now widely accepted within the archaeological community that Andean civilization developed *in situ* without any external diffusion from other autochthonous civilizations (Burger 1992). The Pre-ceramic construction in Peru is the oldest known instance of monumental architecture in the New World (Burger 1992).

Current archaeological discoveries indicate that in the Central Andean Highlands, sedentism, social differentiation, agriculture, pastoralism, and urbanism were attained independently of the coastal societies during the Pre-ceramic Period (Dillehay *et al.* 2004). The small valleys of the coast presently contain 28% of Peru's cultivatable land, compared with 55% in the highlands. This asymmetry was mirrored, until recently, in the demography of Peru. In 1940, 62% of the population resided in the highlands with the heaviest settlement between 3,000 metres and 4,000 metres above sea level (m asl) (Burger 1992).

2.2 Andean Chronology

In the late 1800s, Max Uhle, was the first to create a time-depth sequence based on Peru's archaeological record (Moseley 2001; Uhle 1903). Uhle stratified the time periods into Horizons and Intermediate periods. Horizons were bands of time, unified by a large civilization, while the Intermediate periods were times of autonomous local rule. For instance, the Initial Intermediate Period (1800 – 900 BC) has been characterized by the appearance of ceramics, increased impact of agriculture, an organized labour force, proliferation of monumental architecture and highly developed art styles. The Early Horizon (900 – 200 BC) in contrast, is recognized by the Chavin civilization, intensified regional trade and metallurgical innovations (Kembel and Rick 2004). Building on the theme of horizons and intermediate periods, Julio Tello elucidated the earlier characteristics of Peruvian civilization (Moseley 2001). In the 1950s, in conjunction with radiocarbon dates, John Rowe utilized the Ica Valley collections and the template created by Uhle to solidify a chronologically defined 'master sequence' of horizons and periods (Rowe 1962). However, the time sequence is in no way complete, and is consistently being adjusted by discoveries and information obtained by modern scholars and the ever-growing archaeological record (see Figures. 2.1 - 2.3).

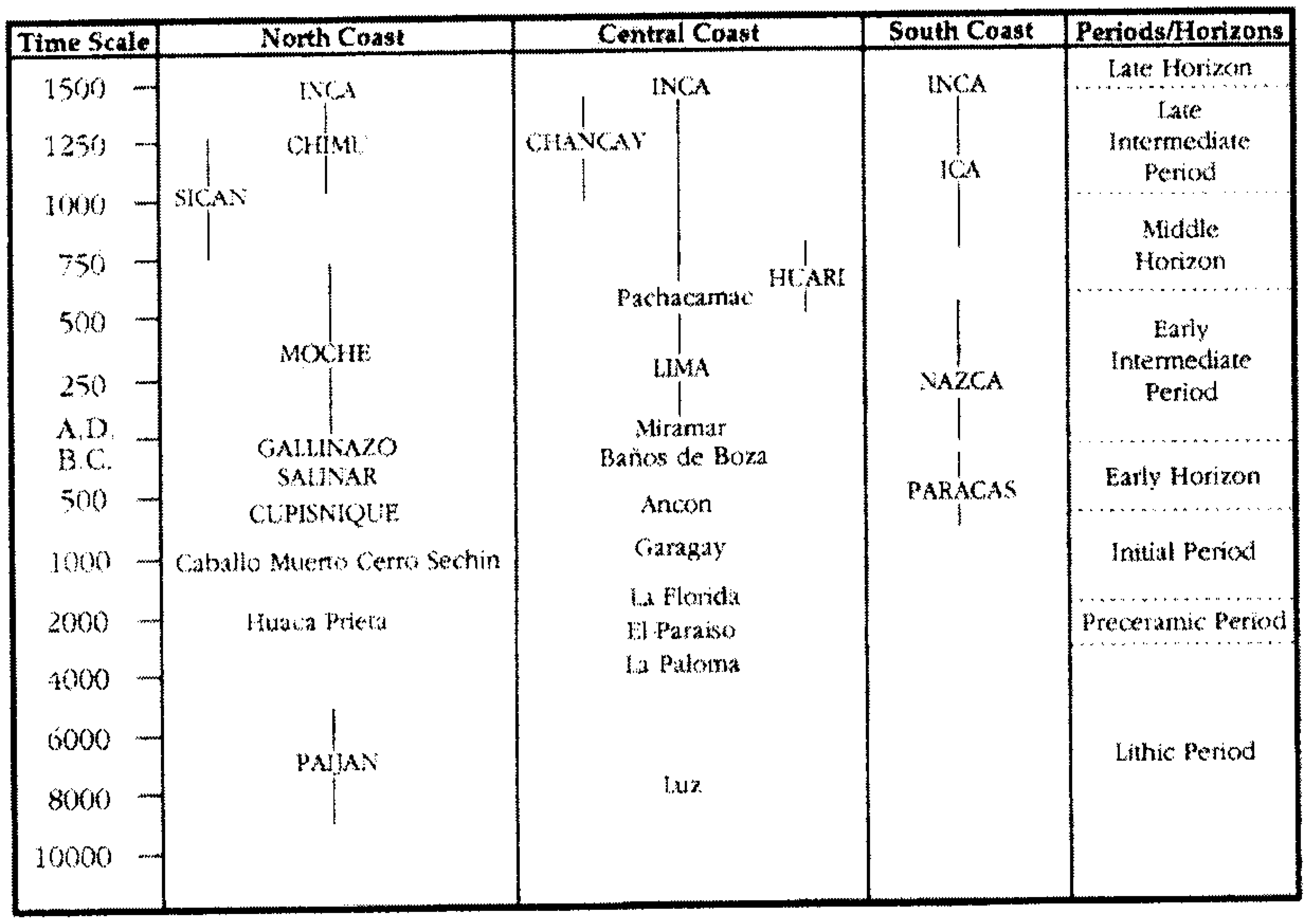

Figure 2.1: Chronology of the coast of Peru (Moseley 2001:22).

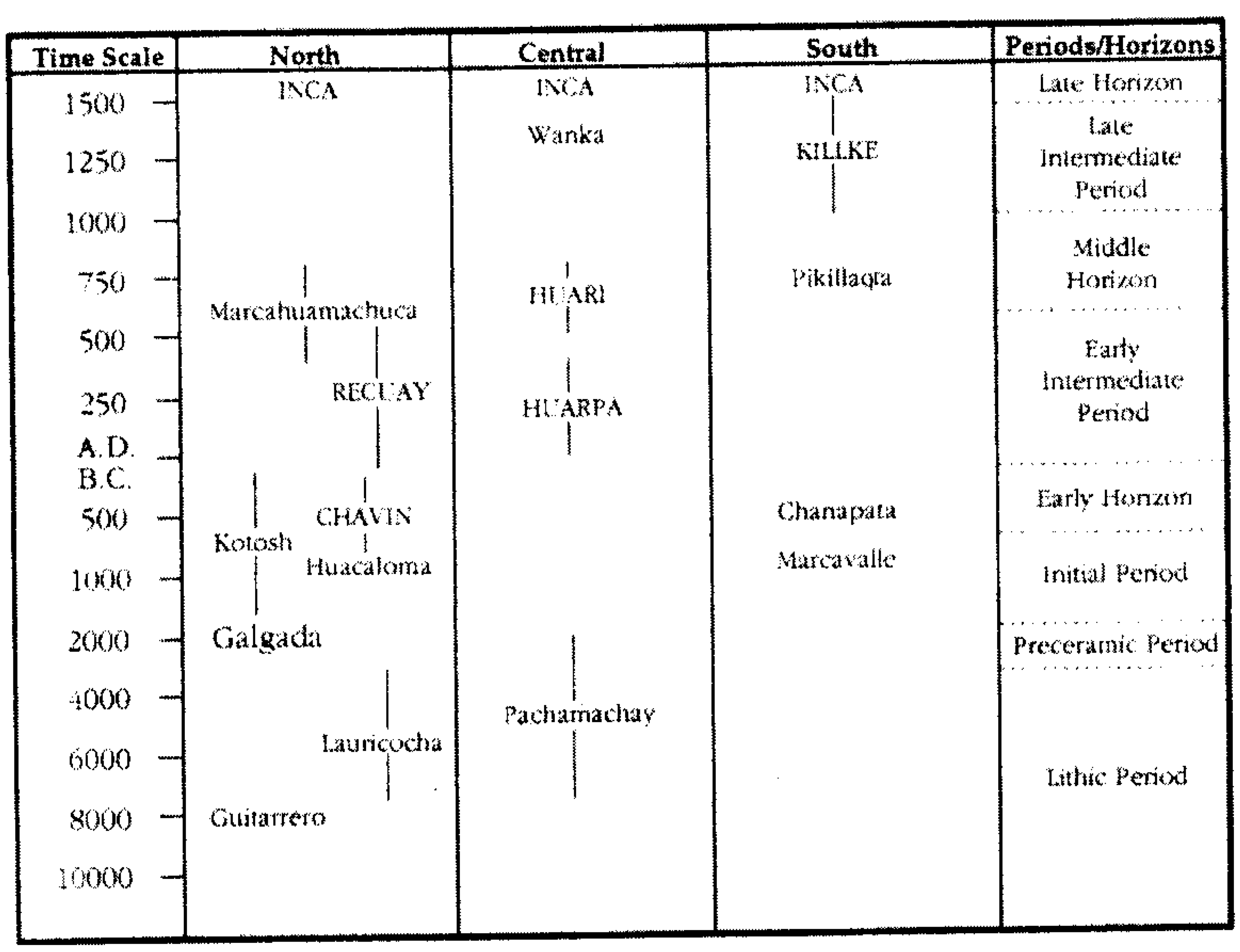

Figure 2.2: Chronology of the Highlands of Peru (Moseley 2001:23).

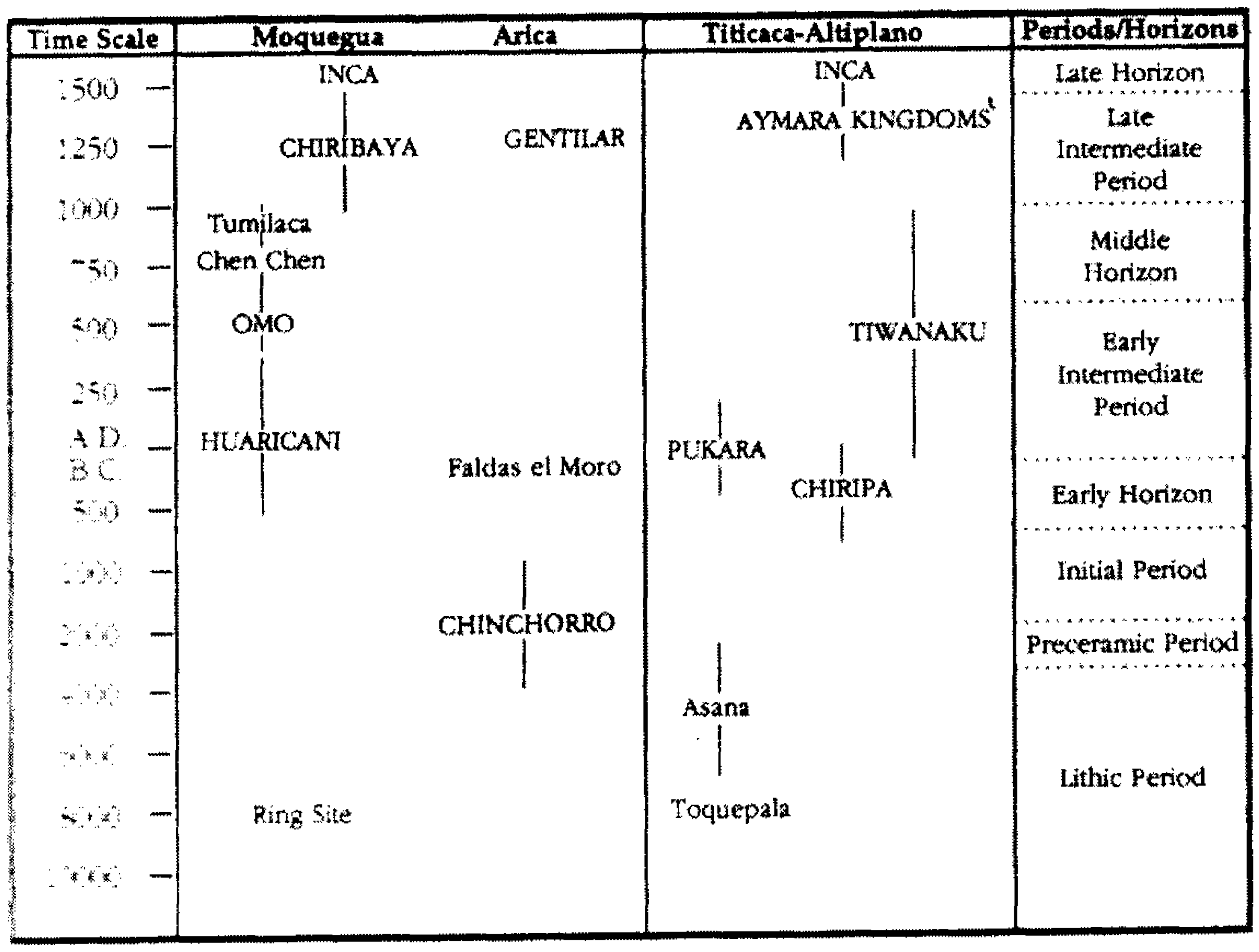

Figure 2.3: Chronology of the Titicaca region of Peru (Moseley 2001:23).

Although the aforementioned chronology has been used as the standard time sequence for Andean scholarship, not all authors adhere to it formally. For instance, Moseley (1975) believes that Andean chronology should be based on absolute dated samples of archaeological remains from different points along the trajectory of cultural change. Similarly, Silverman (2004:13) states that Andean scholars should stop using standard nomenclature to categorize all temporal periods. Instead she thinks that the information obtained from the archaeological record should be discussed using carbon dating. Her perspective seems appropriate when trying to place highland sites and coastal sites into the same temporal categories; especially since some of these sites may not have been affected directly by the larger overarching civilization(s). For the purposes of this research the chronological table outlined by Topic and Topic (1984:77) will be used (see Figure. 2.4). This has been done to standardize the results and interpretations with previous research in the Condebamba Basin. Where applicable, radiocarbon dates will be mentioned.

PERIODO	ANOS	FASE-PHASE	YEARS	PERIOD
Horizonte Tardío	1532 d.c.	Santa Barbara	1532 A.D.	Late Horizon
	1476		1476	
Período Intermedio Tardío		Tuscan		Late Intermediate Period
	1000		1000	
		Late Huamachuco Huamachuco Tardío		
Horizonte	800		800	Middle
		Amaru		
Medio				Horizon
	600		600	
Período				Early
		Early Huamachuco Huamachuco Temprano		
Intermedio	300		300	Intermediate
Temprano		Purpucala		Period
	200 a.c.		200 B.C.	
Horizonte				Early
		Sausagocha		
Temprano				Horizon
	900		900	

Figure 2.4: Temporal chronology of the Huamachuco region (Topic and Topic 1984:77).

2.3 Peruvian Osteological Literature

With preservation of organic materials so exceptional on the arid coast of Peru, past literature has largely ignored the poorly preserved skeletal remains from the Highlands. This makes finding comparative information on the osteological analysis of ancient Peruvian skeletal material from the Highlands extremely difficult. Past Peruvian Highland osteological studies were either confined to a few brief lines about overall osteological findings of a site, i.e. how many males/females, age ranges observed, with little mention of the methodology used, or focused heavily on trepanation and cranial modification. It was not until the advent of bioarchaeology that osteological analysis of skeletal remains was used to understand broader topics in the Highlands of Peru, such as health, social complexity and status.

A noteworthy example of the recent bioarchaeological approach to Peruvian Highland skeletal materials is Verano's (2003a) re-examination of the human remains recovered from Machu Picchu. Other sources of information on Highland skeletal material can be found in: Torres-Rouff's 2003 doctoral dissertation on cranial modification; Blom's 1998 doctoral thesis on Tiwanaku regional interaction and social identity; Tung's (2003) doctoral thesis on the impact of Wari imperialism on the heartland and hinterland during the Middle Horizon (AD 550 to 1000); and Santoro *et al*'s. (2005) exploration into intentional human taphonomic intervention of Palaeoindian/Archaic human remains.

2.4 Sacrifice, Dismemberment and Burial Ritual in Precolumbian Peru

Given the context of the burial under the Castillo, and the visible cut marks on the skeletal remains that have been recovered, it was relevant to explore the topics of sacrifice and dismemberment. Since dismemberment is one of a suite of traits used to define/recognize cannibalism in the archaeological record, the topic of cannibalism has also been examined, even though there is little evidence of cannibalism in the Andes.

2.4.1 Iconographic Evidence

Social psychologist René Girard (1977:300) states that, "Sacrifice is the most crucial and fundamental of rites; it is also the most commonplace". Nowhere better illustrates this concept than Precolumbian Central and South America, where human sacrifice was practiced extensively. Based on the broad definition of human sacrifice proposed by Eeckhout and Owens (2008:380), which states that human sacrifice, "would be *any* killing of an individual for ritual/symbolic purposes", colonial sources are replete with references to hundreds, and even thousands, of people being sacrificed to the Maya, Aztec, Inca and Mountain gods. Precolumbian iconography and art, which predate the Inca in Peru, abound with images and references to human sacrifice. Only in the last few decades have archaeological and osteological materials begun to corroborate the ethnohistoric and iconographic sources. Discovered at pre-Incaic archaeological sites, non-cemetery deposits of human osteological remains display definitive proof of human sacrificial practices, such as throat slashing, decapitation and dismemberment (Hamilton 2005; Benson 2001; Toyne 2008; Verano 1995).

The earliest examples of iconographic depictions of decapitation and dismemberment come from the Initial Period (ca. 1500 BC) site of Cerro Sechín, located in the Casma Valley of north central Peru (Samaniego *et al.* 1985). Reliefs are carved into over three hundred granite monoliths that comprise a huge wall, as well as numerous sculptures, with depictions of bodies that have been disembowelled, decapitated and dismembered (Hamilton 2005; Samaniego *et al.* 1985).

The Peruvian highlands have provided iconographic evidence of severed heads from the Early Horizon and the following Early Intermediate Period. These depictions are present in Chavín art (900 to 200 BC) from the eastern slopes of the Cordillera Blanca (Rowe 1962), as well as the northern highland site of Kuntar Wasi (Burger 1992) and southern highland site of Pucará (Doig 1966). Severed head motifs were also found in iconographic images from the south coast cultures of Paracas (700 to 1 BC) and Nasca (100 BC to AD 700). These images are found on textiles, ceramics and pyro-engraved gourds, and have traditionally been described as trophy heads (Proulx 2001).

Trophy head iconography can also be witnessed in the Early Intermediate and Middle Horizon cultures of the southern Peruvian highlands, i.e. Tiwanaku (AD 1-1000) and Wari (AD 600-1000). In Wari art, the only indications of dismemberment present are severed heads and other limbs (Hamilton 2005). In contrast, several different iconographic forms of dismemberment are depicted in the north coast Moche (AD 100 to 800) culture, in conjunction with scenes of warfare and prisoner sacrifice (Alva and Donnan 1993; Bourget 2001b; Donnan and McClelland 1979, 1999; Verano 2001)

Following the end of the Moche culture, prisoner sacrifice and mutilation iconography continued into the succeeding Lambayeque (AD 800-1350) and Chimú (AD 900-1550) cultures. Iconographic images have been found on ceramics, textiles and wooden objects that have been recovered from the archaeological record (Hamilton 2005; Verano 1986). From these iconographic examples, it is evident that sacrifice and dismemberment were prevalent practices throughout Peruvian history. These images can be found continuously throughout the Andean region from the Initial Period through to Spanish contact.

2.4.2 Archaeological and Taphonomic Evidence for Human Sacrifice

Mortuary practices in the Precolumbian Andes were extremely eclectic. They ranged from ancestor veneration, mummification, dedicatory burials, to secondary offerings of remains and even human sacrifice. It is thought that the Ancient Peruvians believed that even inanimate objects had a life force. Therefore, humans, animals and objects were all considered to be valuable offerings to the Gods (Benson 2001, Rowe 1946).

While the Moche offered both domestic and wild animals as sacrifices, the Inca appeared to prefer domesticated animals (Benson 2001; Cobo 1990). In both the Moche and Inca cultures, llamas were often the animal of choice, with their use as sacrificial offerings being abundant both spatially and temporally (Donnan 1995). In the main ceremonial structure at the site of Tiahuanaco, fourteen disarticulated llamas were found purposefully arranged and intermixed with special objects (Kolata 1993). At the site of Chan Chan, the Chimú buried a large number of llamas (Conrad 1982). At the site of Túcume on the northern coast, thirty-one llama burials were found in the Inca-period temple of the Sacred Stone (Heyerdahl *et al.* 1995).

Llamas were not the only mammal sacrificed to the Gods. Numerous claims of human sacrifice and dismemberment have been made in regards to the ancient Peruvians; however, with the exception of Nasca trophy heads (Browne *et al.* 1993; DeLeonardis 2000; Proulx 2001; Verano 1995), few authors corroborated their beliefs with osteological evidence, e.g. cut marks. Uhle (1903) was the first to uncover, systematically record and analyze archaeological evidence of human sacrifice from the Inca site of Pachacamac, on the central coast of Peru. Due to excellent preservation, Uhle excavated a cemetery containing the bodies of several female sacrifices. As a result of the arid climate, the bodies were naturally mummified, and still displayed tightly knotted cloth ligatures around their necks. Eeckhout and Owens (2008) recently published more data from the site of Pachacamac on what they label as "potential sacrificial individuals" or "PSI". Most of the PSI's appear to be children under the age of eight years.

Three deep, cylindrical, stone-lined subfloor cists were located at the highland site of Cheqo Wasi (Cook 2001; Isbell *et al.* 1991). The cists were sealed with a circular and two rectangular capstones and located underneath the plaster floor. The contents of the subterranean cists included decorated pottery, chrysocolla gemstone (semi-precious) beads, *Spondylus* shell artifacts and human bone. Similarly, Unit 47-A, 47-B and 36-A at the site of Pikillacta, all had subterranean floor pits that contained offerings of camelid bone and *Spondylus* shell (McEwan 1998). The site of Aqo Wayqo had a single juvenile individual, under the age of five, located inside a tomblike cist. Since the juvenile was interred with ceramic *tupus* (shawl pins) and lithics, it has been inferred that the child may have been a sacrificial victim (Cook 2001).

The majority of the physical evidence for decapitation, defleshing, dismemberment and human sacrifice has come from the North Coast (Hamilton 2005; Hamilton 2005). Evidence of dismemberment can be found at the North Coast sites of El Brujo (Gálvez and Briceño 2001) and Dos Cabezas (Cordy-Collins 2001) and Pacatnamu in the Jequetepeque Valley (Verano 1986). The north coast site of Huaca de la Luna has provided a plethora of evidence. At Huaca de la Luna, Plaza 3A revealed a mass sacrificial burial, which contained approximately 70 adolescent and young adult males between the ages of 15 and 39 years (Hamilton; 2005; Bourget 2001a, 2001b; Verano 2001). Analysis of the stratigraphy revealed at least five distinct sacrificial episodes, with fifteen layers of superimposed human remains (Bourget 2001a, 2001b). Due to their narrow age range, sex bias, robusticity, healed fractures and the fact that approximately 75% of the individuals have cut marks indicating that their throats had been slit, Verano (2001) interprets the sacrificial victims to be male war captives.

Adjacent to Plaza 3A at Huaca de la Luna, excavations of Plaza 3C recovered partially disarticulated remains of at least six adolescent/young adult males (Hamilton 2005). Due to their close proximity to the sacrificial victims of Plaza 3A, Verano (2001) hypothesizes that these individuals were also victims of sacrifice. In contrast to the remains recovered from Plaza 3A, the victims from Plaza 3C displayed more indications of dismemberment. In this skeletal assemblage, there was a high concentration of cut marks around long bone epiphyses and muscle attachment sites. Verano (2001) suggests that the Plaza 3C individuals were intentionally defleshed, dismembered, and may even have been cannibalized.

2.5 Previous Cut Mark Studies

There exists a vast amount of literature pertaining to cut marks on human/non-human bone and their potential relationship to human behaviour, especially zooarchaeological studies analyzing cut marks and their relation to animal butchery and meat processing (Abe *et al.* 2002; Binford 1981; Flannery 1967; etc.). This thesis however, will focus on cut marks that were intentionally made on human bone.

2.5.1 Violence, Human Sacrifice and Cannibalism

Cut marks are often linked to sensational topics like violence, human sacrifice and cannibalism. Numerous studies have assessed cut marks on the cranium as the result of scalping (Allen *et al.* 1985; Bridges 1996; Bueschgen and Case 1996; During and Nilsson 1991; Owsley 1994; Owsley and Berryman 1975; Smith 1995). Cut marks have also been cited as evidence for: mutilation and torture (Luff 1996; Melbye and Fairgrave 1994, 1990; Olson and Shipman 1994; Verano 1986, 2001; Zimmerman 1997), the taking of body parts and heads as trophies (Andrushko *et al.* 2000; Drusini and Baraybar 1991; Owsley *et al.* 1977; Pickering 1985; Smith 1993, 1997; Verano 1995, 2001), slitting the throat and decapitation (Cordy-Collins 2001; Garland 1995; Frayer 1997; Harman *et al.* 1981; Liston and Baker 1996; McKinley 1993; Milner *et al.* 1991; Molleson 1991; Pijoan and Mansilla 1997; Smith 1995, 1997; Verano 1986, 2001; Zimmerman 1997), as well as warfare and other forms of violence (Blakely and Matthews 1990; Floinn 1995; Haas and Creamer 1993; Hollimon and Owsley 1994; Hutchinson 1996; Marques *et al.* 2000; Molleson 1991; Willey 1990).

When cut marks on human bone are found to create patterns around epiphyses and/or muscle attachments sites, arguments of ritual or dietary cannibalism arise (Fernández-Jalvo *et al.* 1999; Degusta 2000; Graver *et al.* 2002; Hurlbut 2000; Jamieson 1983; Kantner 1999; Lambert *et al.* 2000; Melbye and Fairgrave 1990, 1994; Turner and Turner 1992, 1999; Villa 1992; White 1992), since dismemberment and defleshing are two of the six minimum criteria Turner and Turner (1999, see also Turner 1983) use in the identification of cannibalism (see also Villa 1992 and White 1992). Other researchers interpret dismemberment and defleshing cut marks as the result of ritual execution and subsequent disposal of witches (Darling 1998; Ogilvie and Hilton 2000), human sacrifice

(Blom *et al.* 2003; Green 1999; Jamieson 1983; Jelínek 1993; Pickering 1985; Pickering and Foster 1994; Pijoan and Mansill 1997; Verano 1986, 2001), or violence, especially as it pertains to warfare (Melbye and Fairgrave 1990, 1994; Milner *et al.* 1991; Molto *et al.* 1986; Owsley *et al.* 1977; Willey 1990).

2.5.2 Post-mortem Modification

Warfare, dismemberment, sacrifice, cannibalism, witchcraft, and other violent events are not always responsible for cut marks on human bone. Cut marks on human bone can be the result of non-violent activities, such as autopsy and embalmment (Molleson 1991; Start and Robertson 1998; Valentin and d'Errico 1995), preparation of the body for interment (Blom *et al.* 2003; Degusta 2000; Feagins 1989; Haverkort and Lubell 1999; Guillén *et al.* 2009; Olsen and Shipman 1994; Smith 1997; White 1986), and the creation of musical instruments and other ritual items (Cybulski 1978; Dixon 1959; Hester 1969; Hoyme and Bass 1962; Jamieson 1983; Owsley *et al.* 1994; Willey and Emerson 1993).

2.5.3 Taphonomy of Wall Burials

Burials inside walls of niched halls are not unique to Marcahuamachuco. Similar burials have been found at the ancient highland sites of Pikillacta and Kuelap. Built at an elevation of 3250 m asl, the archaeological site of Pikillacta is believed to have been a provincial capital for the Wari Empire during the Middle Horizon, AD 540 to 900 (McEwan 1998). The site intercepts the main north-south route that connects highland Bolivia with central and northern Peru. The site is also situated in a way that it acts like a gateway to the two most productive agricultural zones in the southern Peruvian highlands: the Cuzco and Vilcanota/Urubamba Valleys (McEwan 1998).

The niched halls at Pikillacta were completely roofed, and devoid of an open internal patio. They are defined by the presence of internally rounded corners, large niches in the walls, and offering pits in the corners of the rooms and underneath the doors (McEwan 1998). For example, Unit 10 had an offering pit that contained ten human skulls in the west corner of a niched hall (McEwan 1998). Viracochapampa, a neighbouring site of Marcahuamachuco, has often been compared to Pikillacta. Similar to

Pikillacta, a secondary deposit of several bodies was found as an offering in a cavity in the corner of the structure (Topic and Topic 1983b). Surprisingly, the excavations of the niched halls at Pikillacta uncovered few artifacts, which McEwan (1998) believes to have been directly related to the installation of gypsum plaster floors.

Kuelap, believed to have been constructed as a fortified walled stronghold in a response to Wari expansion over the central highlands and the coast of Peru, was occupied from approximately AD 800 to 1500 (Muscutt 1998). Many of the structures appear to have served ceremonial funerary functions, including the perimeter walls. Archaeologist Alfredo Narváez has concluded that the outer wall was used as both a defense mechanism and a cemetery (Muscutt 1998). Kuelap is now littered with human bones exhumed and scattered by *huaqueros.*

Through analysis of the wall burials and skeletal remains, it has been determined that the ancient Chachapoyas eviscerated, dried and wrapped corpses in textiles, typically in the fetal position, to prevent putrefaction and excessive odour inside the city of Kuelap (Muscutt 1998). Osteologically, many of the recovered skulls show fractures, possibly from battle wounds and/or marks of sacrificial execution. Trepanning was also prevalent, although the reasoning behind the practice is currently unknown. Several incidences of trepanation in various stages of healing have been found. However, most skeletal remains show no signs of healing following the trepanning procedure, indicating that the patients and/or victims did not survive (Muscutt 1998).

2.5.4 Modern Forensic Applications

Within the forensic context, cut marks on human bone have typically been associated with the identification of trauma patterns. In particular, studies such as that by Symes *et al.* (2002), attempt to identify the weapon used to inflict sharp force trauma wounds (Bonte 1975; Sauer 1984, 1998; Sauer *et al.* 1988). Forensic scientists also attempt to determine if a wound occurred perimortem or post-mortem (Houck 1998; Sauer 1998). This information could be pertinent in establishing the sequence of events for a crime or help understand ancient cases of dismemberment. As well, forensic scientists have used cut marks to reproduce heinous crimes, which involve post-mortem modification of human corpses. These scientists look at the patterning and morphology of the cut marks, in an attempt to reconstruct the techniques used to dismember the body, as well as the tool that was used during the commission of the crime, i.e. knife, saw, axe, and so forth (Houck 1998; Reichs 1998; Symes *et al.* 1998). For the forensic scientist, these analyses are vital to understanding the crime and hopefully prosecuting the perpetrator.

2.5.5 Other Cut Mark Research

In contrast to using cut marks as a medium to solve a crime or infer ancient human burial practices and ritual behaviour, several researchers have turned to experimental and archaeological studies that focus on what the tool marks indicate about the actual behaviours of the individual who created them. For instance, several studies have looked at ways to distinguish between different tool types, i.e. stone versus metal, in an attempt to determine which tool created the cut marks on the human bone (Greenfield 2002; Houck 1998; Olsen 1988; Olsen and Shipman 1994; Walker and Long 1977). Other studies have included: the examination of directionality of the cutting motion (Bromage and Boyde 1984; Houck 1998; Olsen and Shipman 1994); the determination of the sequence of overlapping and intersecting cut marks (Potts and Shipman 1981, Shipman 1981; Shipman and Rose 1983); and the analysis of immediate versus delays in the processing of bone (Houck 1998; Russell *et al.* 1985; Shipman 1988).

2.5.6 Summary

There are many plausible interpretations that can account for cut marks on human bone, ranging from violent reasons, such as sacrifice and intentional mutilation, to the more mundane, i.e. preparation of the body for burial. Therefore, other variables must be taken into account when analyzing human skeletal remains that contain cut marks. Several of the key points to consider include: context; number of marks; location and patterning of the cut marks and the human skeletal remains; the completeness of the bone, i.e. is it fragmentary or whole; the age, sex and health of the individual(s); the presence or absence of antemortem and perimortem trauma; the traditional mortuary customs of the culture/temporal period in which the individual(s) died; presence or absence of grave goods; presence or absence of weaponry and other taphonomic changes the bones have undergone, i.e. exposure, carnivore/scavenger activity, etc. Only when all these different aspects are considered, can the purpose behind the cut marks on the bone be determined.

Cut marks and incised indentations on bone are invaluable tools for understanding perimortem and post-mortem treatment of human skeletal remains. Through the analysis of cut mark patterning and the determination of the probable tool(s) used in the production of the markings, human behaviour can be inferred. Of particular importance in this thesis, were the frequency, orientation, location and morphological characteristics of the intentional human alterations to the bone (see Table 3.3). These marks were in turn used to assess the different death rituals practiced by the inhabitants of Marcahuamachuco and Cerro Amaru.

2.6 Site Background

The first informative and detailed report of monumental architecture in the Condebamba Basin, where both Marcahuamachuco and Cerro Amaru are located, was published by McCown in 1945. His analyses were derived from surveys and excavations he carried out in 1942. The second important resource is a 1972 dissertation written by Thatcher. The Topics rely extensively on the ceramic dating sequence Thatcher created for the area, based on seriation of ceramics collected from the surface of 80 sites. Although the Topics have found some discrepancies in the dating system, they have confirmed much of the chronological framework through their own excavations and radiocarbon dates (Topic and Topic 1982). Beginning in 1981, John and Theresa Topic, their students and colleagues have worked at the site and in the area and continue to do so in the present day (e.g. Guillén *et al.* 2009; Loten 1987; Shaughnessy 1984; Topic and Topic 1984, 1987 and 1992).

2.6.1 Marcahuamachuco

The archaeological site of Marcahuamachuco is located near the modern city of Huamachuco, Peru. Topic and Topic (1983a:6) state that "the most important site in the Huamachuco area is Marcahuamachuco ... with a unique architectural style emphasizing multi-storied buildings". It is the preeminent local site and is situated on a high plateau that overlooks the surrounding valleys. With the exception of the southwest side of the site, the area is surrounded by steep drop-offs, with rivers approximately 500 meters below. The southeast side of the site has a modern road and older footpaths that connect the site to Cerro Amaru and the modern town of Huamachuco (Topic and Topic 1982). With an area of approximately 2.4 km^2 and located at an elevation of approximately 3700 meters above sea level, the site dominates the surrounding landscape (see Figure. 2.5).

Through radiocarbon dating and previous excavations, the Topics (1988a and 1988b) have determined that the site was occupied between AD 400 and AD 1460, with its florescence around AD 500 to 800. In regards to previously established Andean chronology, Marcahuamachuco was inhabited from the Early Intermediate Period through to the Late Intermediate Period. This implies that Marcahuamachuco was occupied during the Wari expansion, AD 700 to 1000 (Morris and Von Hagen 1993).

Previous analyses had interpreted Wari as either the predecessor or destructor of Marcahuamachuco (see Topic and Topic 1983a). It is now evident that Marcahuamachuco was a well-established site before the Middle Horizon and maintained its prominent position throughout the Middle Horizon. Although there is evidence of Wari influence at the nearby site of Viracochapampa, occurrences of Wari decorated ceramics are limited at Marcahuamachuco to a possible ceremonial centre. Thatcher's (1972) work with ceramics corroborates this interpretation (Topic and Topic 1983a).

The site contains various forms of monumental architecture surrounded by a large expansive wall. As McCown (1945:254) states:

> Even granting that the chiefs or kings resident on Marcahuamachuco, controlled the surrounding valleys visible from the mountain and were able to demand the services and time of the peasants living in other settlements in the district, the amount of labour expended on the various buildings and on the defence[2] wall was tremendous.

Despite the grand architecture and massive wall, the Topics believe that Marcahuamachuco was only intermittently occupied during its 1000 year history. They view the site as a regional ceremonial center, where the population from the surrounding Condebamba Basin would congregate periodically for social, political, economic and

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[2] Other than the fact that the wall is massive and surrounds the site of Marcahuamachuco, the Topics have found no archaeological evidence to support the wall's function as a defensive structure (Topic and Topic, personal communication.).

Figure 2.5: West half of the reconstructed plan of Marcahuamachuco, created by Dr. Andrew Nelson (Topic and Topic 1988).

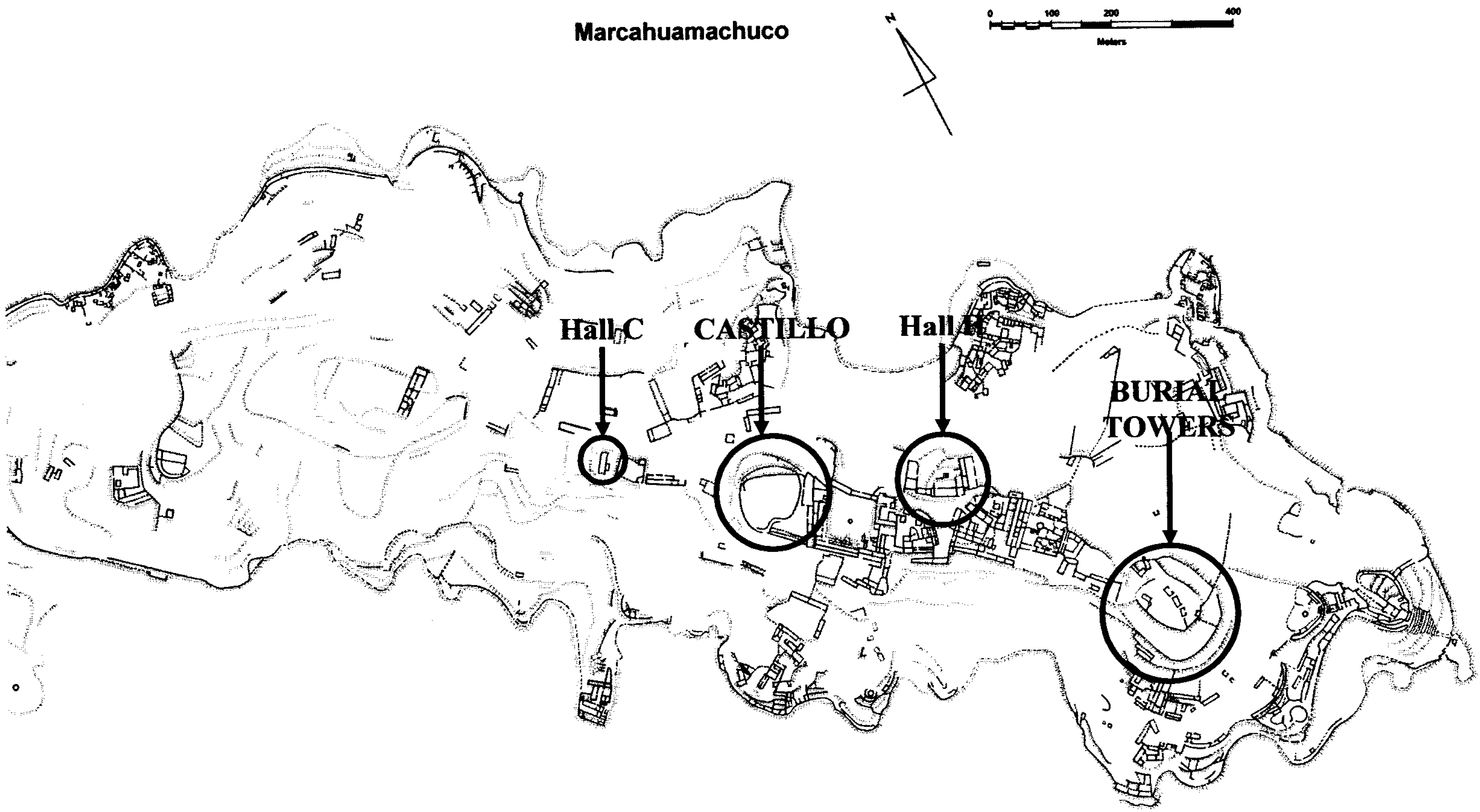

Figure 2.6: East half of the reconstructed plan of Marcahuamachuco, created by Dr. Andrew Nelson (Topic and Topic 1988). Relevant parts of the site are highlighted

ritual purposes. The Topics believe that the population was organized through kinship or ayllu, with ranked lineages based on attributes such as size, wealth and ritual priority of the site (Topic and Topic 1993).

Ancestor veneration typically involves a family and/or ayllu, who perform periodic ceremonial practices that may include burial customs and funerary rites. These practices revolve around the idea that specific progenitors possess supernatural capabilities after death, which can directly affect the living descendants. The family or ayllu worships the descendant and/or ancestor to ensure that they remain in favour, i.e. have fertile crops, ward off sickness, and have success in warfare. Many also believed that their ancestors held special rights over former property (Lau 2002). Therefore, from the cultural material remains, the sheer size of the site, the magnificent architecture, types of building structures present, as well as the fact that the site dominates the surrounding area, the Topics have determined that the site was once a major centre devoted to ancestor worship (Topic and Topic, personal communication).

In the Condebamba Basin, there are several different and impressive stone mortuary buildings. The first are four large burial towers (see Figures 2.6 and 2.7), which are described and illustrated by Loten (1987). The large stone towers are inferred to be burial structures based on similar construction and style found at other highland Peruvian sites. However, no human skeletal remains have been found inside the structures at Marcahuamachuco.

Wall niches are another style of burial enclosure found at Marcahuamachuco. They are formed by a flat, thin stone lintel on top, and two large rocks that form either side. The openings were roughly 70cm high by 60 cm wide and 60 cm deep. Based on construction, it is probable that burial niches were roughed into the walls for future use. After death, individuals would be place within the niches, and later sealed inside with stone and mortar (Topic and Topic 1987).

Based on the large number of interments, Topic and Topic (1988a) believe that the niched halls secondary function may have been a mausoleum. At Marcahuamachuco, there are approximately 12 to 15 niched halls, which appear to have been in use simultaneously. For the purposes of this thesis, skeletal material recovered from cuts 63H and 63C, located inside two niched halls, were analyzed (see Figure 2.6). The Topics

(1988a) argue that the niched halls may have served several different social groups, possibly linked by kinship. Therefore, the burials inside the wall niches may represent a form of ancestor veneration.

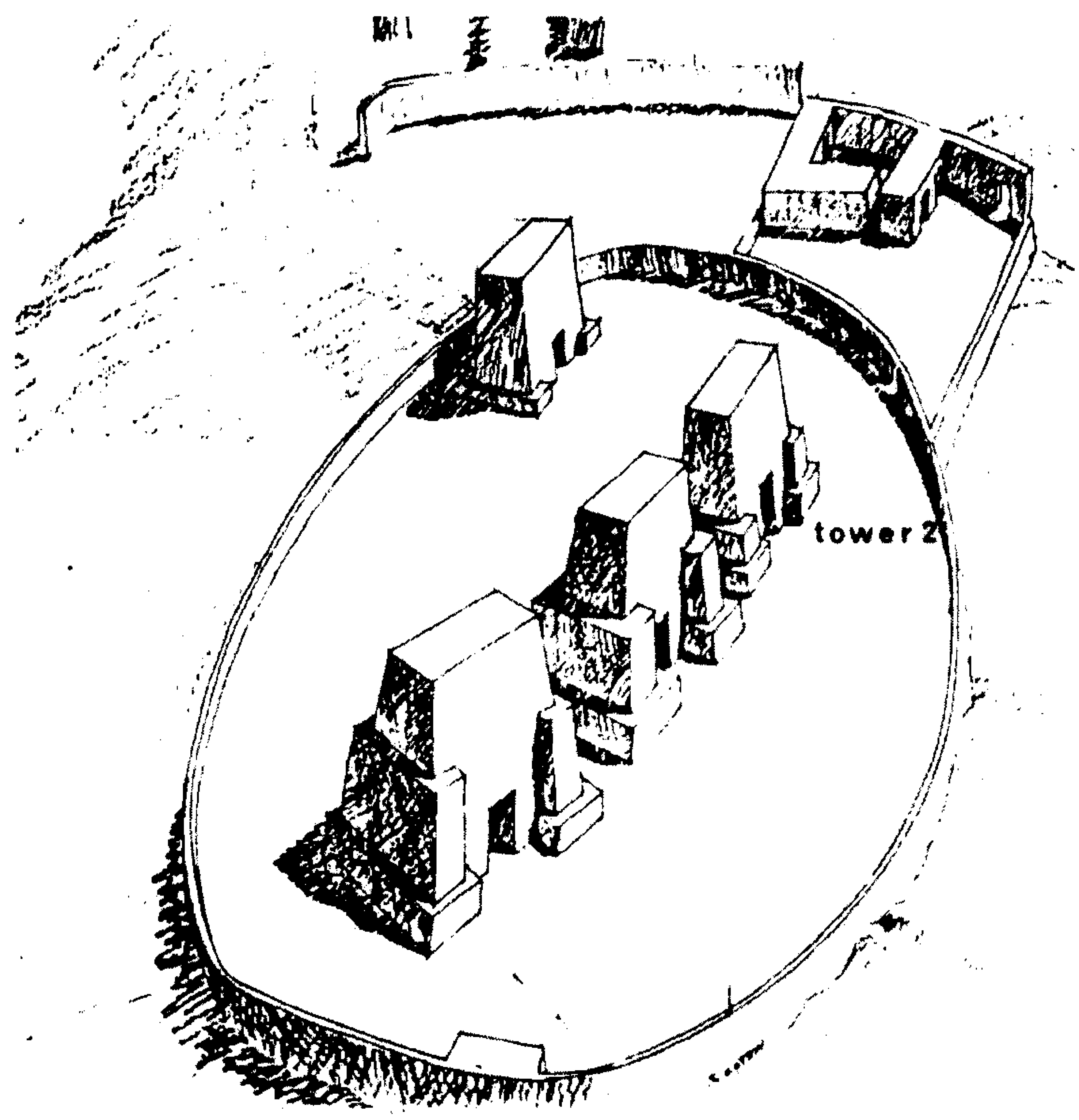

Figure 2.7: A sketch reconstructing the Burial Towers at Marcahuamachuco (Loten 1987: Figure 3).

The Castillo (see Figure 2.6 and 2.8) is a circular structure that was likely five stories tall when it was complete. Although none of the floors are currently intact, multiple rows of corbels are visible on the walls and structural material that was probably used in the construction of the floors has been found inside the walls of the Castillo. Walls and rooms are still evident, and the structure was likely filled with a labyrinth of multi-storied galleries (Topic and Topic 1988b). According to their research, the Topics believe that the Castillo represents the ceremonial heart of the site, and was likely the locus of political and religious power for the people around Marcahuamachuco.

While excavating inside the Castillo, at 4.9 meters below datum, a small offering of turquoise and *Spondylus* shell was located in a deposit approximately 25 by 25 cm. At 8.25 to 8.85 meters below datum, amongst the artificial fill, a thick layer of faunal remains appeared. These remains covered the entire layer of the trench. Unfortunately, due to time constraints and the fact that the faunal bones were interspersed throughout a thick layer of mud, the bones were not cleaned *in situ* (see Figure 2.9).

The faunal bones and matrix were removed in large chunks and brought back to the laboratory for analysis. Once relatively dry, the bones were removed from within the muddy matrix. Upon examination and analysis, 3681 faunal bones were recovered. Of these 3681 bones, 3662 were identified as camelid. The others were all small rodents, i.e. mice. The camelid MNI was determined to be 18, with ages that ranged from neonate to older adult. However, most of the faunal remains belonged to juveniles who were close to adult size. Importantly, the entire camelid skeleton was represented, with most of the faunal bones in anatomical position. This indicated that the carcasses were complete when they were placed in the grave.

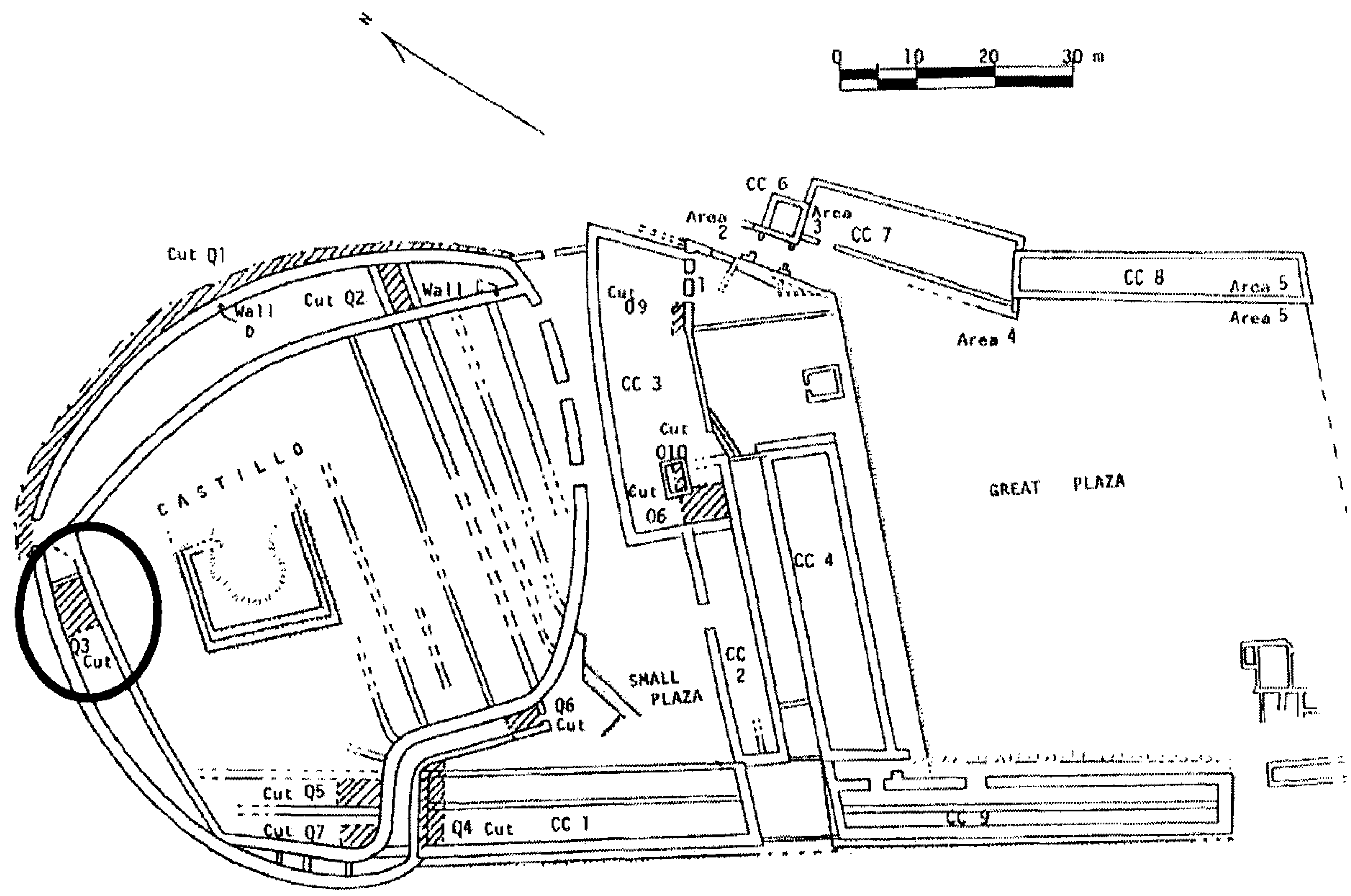

Figure 2.8: Schematic of the interior of the Castillo at Marcahuamachuco, circle highlights cut Q3 (Topic and Topic 1988b: Figure 1).

While completing the analysis of the faunal remains, it was determined that human bone was commingled with the camelid bone. Interspersed with the faunal and human bone was cultural and structural material that indicates that the camelids and the human bone were placed on the floor prior to the building's intentional destruction. For these reasons, the Topics (1988b) suggest that the camelids and human remains were a sacrificial offering.

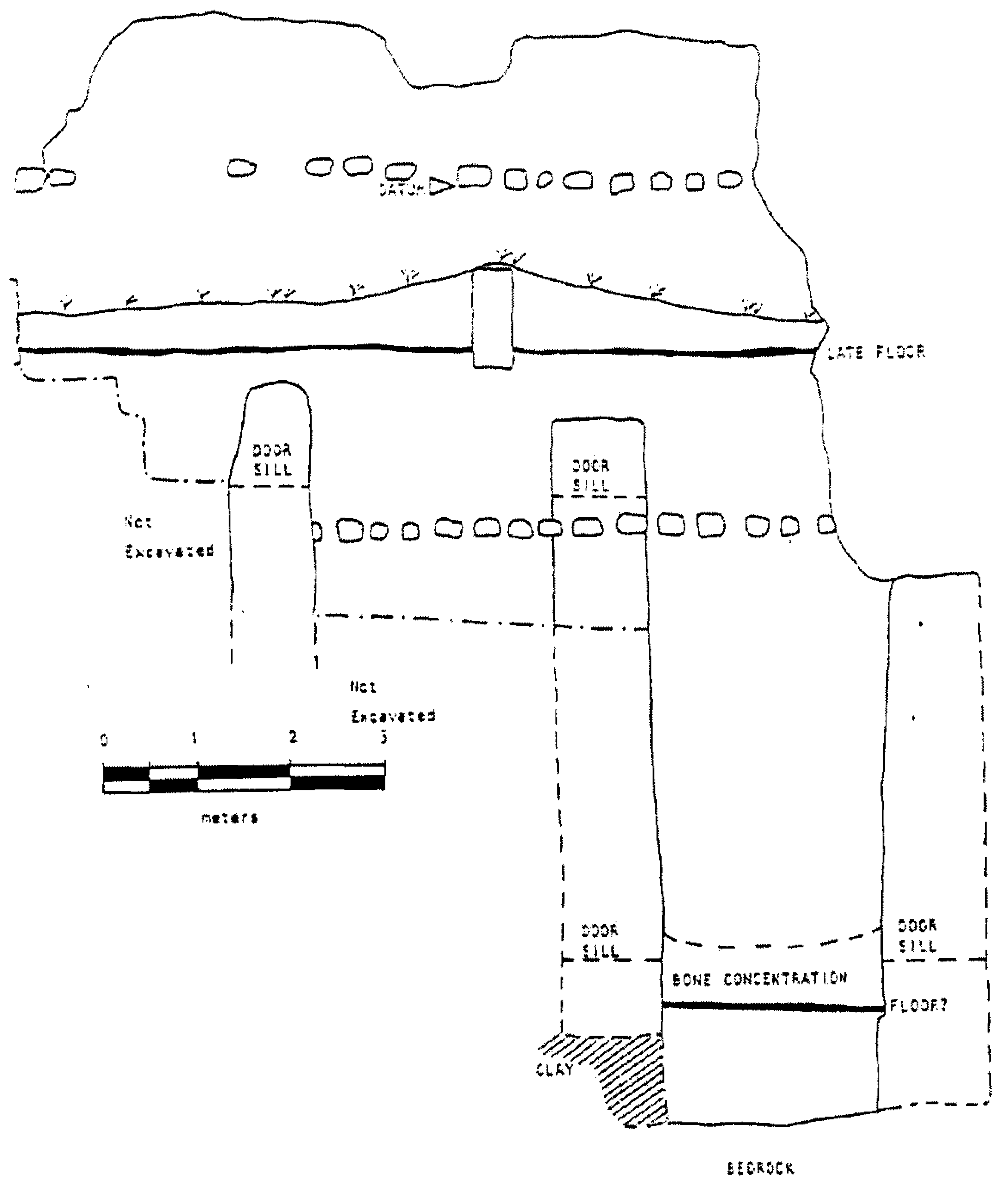

Figure 2.9: Profile of the Q3 excavation inside the Castillo at Marcahuamachuco (Topic and Topic 1988b: Figure 4).

2.6.2 Cerro Amaru

The ceremonial site of Cerro Amaru is located on a hilltop just south of Marcahuamachuco. Cerro Amaru was built in the last half of the Early Intermediate Period, and used during the Middle Horizon. Its importance was first recognized when Uhle (1903) discovered three deep wells, one of which contained thousands of stone and shell beads. Even though Cerro Amaru has little preserved architecture, the previous extent of architecture can be inferred from the large piles of stones modern farmers have cleared from their fields (Topic and Topic 1982).

The relatively small site of Cerro Amaru includes a high-status mortuary monument (Topic and Topic 1993). In the 1983 field season, the Topics excavated the small five by six metre mausoleum that contained human remains, grave goods and burned textiles (see Table 2.1 and Figure 2.10). Based on the quantity and quality of the artifacts found associated with the building, the Topics have inferred that individuals of high status utilized the building as a place to house their venerated dead (Topic and Topic 1984).

Location in Building	Cultural Material	Outside Cultural Influence	Evidence of Looting
Cist 1	Topus, lyre-shaped cups, canteens, spoons, bowls, whistling jar, anthropomorphic figurine, polished bottle	Cajamarca	No
Cist 2	Topus, cups, tripod bowls, bowls, jars, spoons	Cajamarca	Yes
Cist 3	Topus, complete vessels, cups, tripod, solid human figurine, obsidian flake, grey stone bead	N/A	Yes
Main Level	Burnt textile, three nested bowls, copper topus, burnt corn kernels, blackware bowls, ceramic bottle, beaker, obsidian flakes, gold/silver thimble-like objects (from gloves?), 14 silver disks, copper nail, spiral copper pin, silver pin, pyrite mirror	Wari	Yes

Table 2.1: Grave goods associated with the Mausoleum at Cerro Amaru (Topic and Topic 1984).

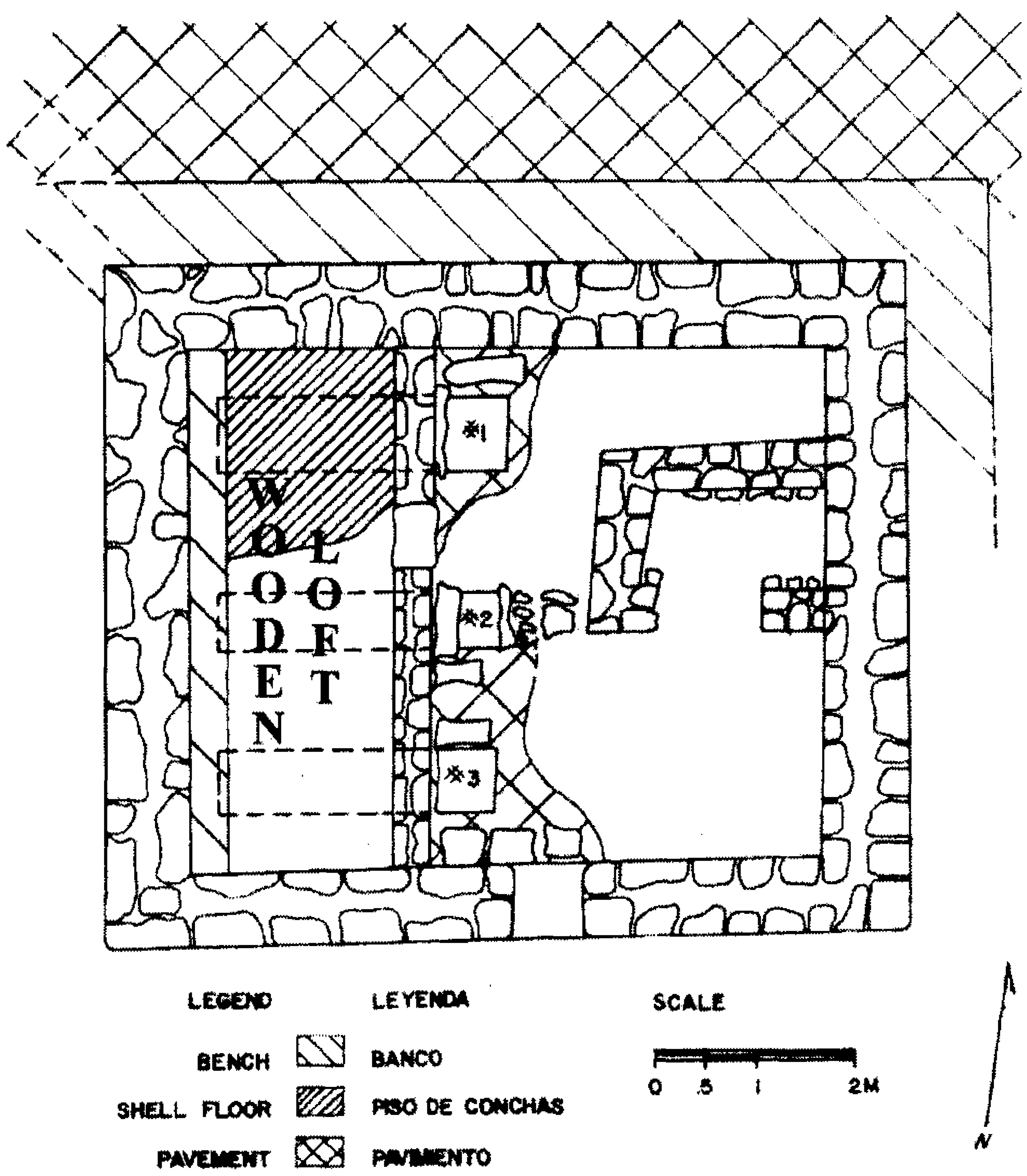

Figure 2.10: Reconstruction of the interior of the mausoleum, with cists 1 through 3 identified (modified from Topic and Topic 1984: Figure 2)

The mausoleum's door was located in the south wall. A low stone wall divided the interior into eastern and western halves. Beneath the floor on the west side of the room, three stone-lidded cists were located. The cists were approximately 2.6 metres long by 0.7 metres wide and 0.8 metres high. All three entrances to the cists were outlined with flat stones, and roofed by long slabs of rock. All three cists contained poorly preserved human skeletal remains. Located inside Cist 1 were two vessels (D and T) that contained human remains. Of the three subterranean cists, only Cist 1 appeared to be undisturbed by looters (Topic and Topic 1983b).

Built above the floor of the mausoleum was a wooden loft, partly supported by a low stone wall (see Figure 2.10 and 2.11). Due to the number of commingled human remains, fine textile fragments, and valuables, it has been inferred that the loft was a repository for mummies and their grave offerings. The subsequent carbonization of the textiles has been attributed to the possible intentional burning of the building (Topic and Topic 1983b).

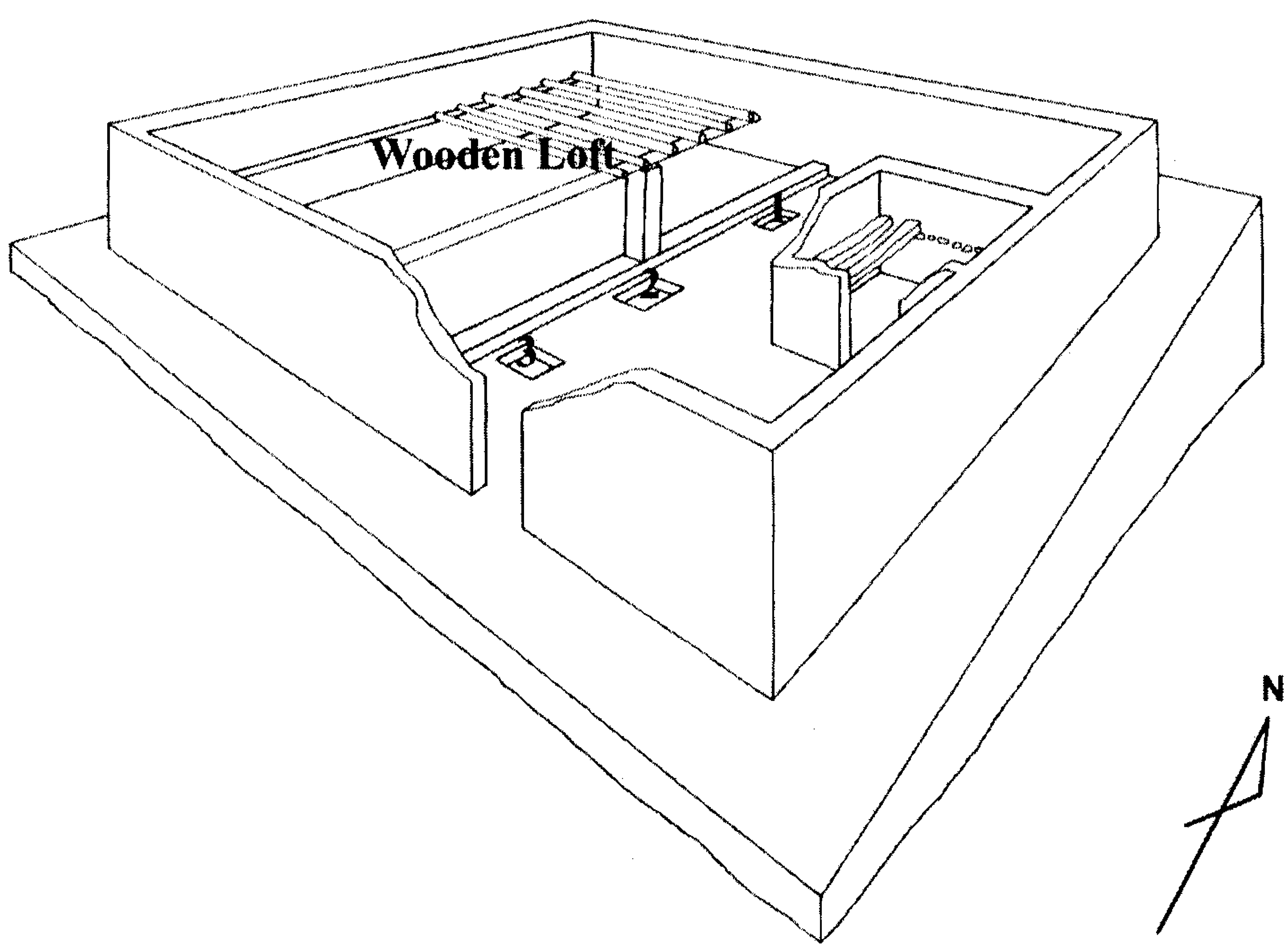

Figure 2.11: Reconstruction of the Mausoleum at Cerro Amaru, with the numbers representing Cists 1 through 3 (modified from Topic and Topic 1992)

Within the walls of the mausoleum, the Topics (1984) also discovered large quantities of decorated ceramics. The ceramics display a noticeable influence from both Wari and from the South Coast. These findings imply a substantial trading network, although the Topics have found it difficult to distinguish between imports, non-local artisan pieces created from materials available locally, and imitations created locally (Topic and Topic 1987). Even with these complications, the ceramics that were recovered from the mausoleum have been identified as belonging to the Middle Horizon.

CHAPTER 3: MATERIALS AND METHODS

Introduction

This chapter outlines the materials, methods and procedures used to complete the inventory and examination of archaeological human skeletal remains excavated under the supervision of Drs. John and Theresa Topic. The entire collection of skeletal material was excavated over several field seasons in the 1980s, from the sites of Marcahuamachuco and Cerro Amaru, site designations 63 and 64 respectively. The two sites, occupied from approximately AD 400 to 1000, are located in the Peruvian highlands, near the modern city of Huamachuco.

3.1 Sample

During the course of the Topics' Huamachuco Archaeological Project in the 1980s, a brief skeletal inventory was conducted by Dr. Theresa Topic and several students. The inventoried skeletal elements were then separated into different baskets and bags based on provenience. The skeletal sample was initially randomly selected from the sorted skeletal material (see Table 3.1). This subset relates to records 1 to 150 in the subsequent database that was created.

Due to time limitations, the rest of the skeletal sample was deliberately chosen from the Topics' preliminary inventory (see Table 3.1) . The intentionally chosen subset of skeletal elements accounts for records 151 through 941 in the database. The bags were purposely selected based on the degree of preservation, type of burial context, and relevance to ongoing research still being conducted by the Huamachuco Archaeological Project. The three main burial contexts include: wall burials located in two niched hall structures (63C and 63H) at Marcahuamachuco; a multiple burial from under the Castillo at Marcahuamachuco; and burials from within the mausoleum at Cerro Amaru (see Table 3.1).

Of the entire collection of human remains excavated by the Huamachuco Archaeological Project in the 1980s, approximately 35% were examined thoroughly. Only a representative sample of the skeletal remains recovered from 63C and 63H were examined by the author. In contrast, the entire recovered skeletal population from both the Castillo (63Q3) and the interior of the mausoleum were recorded, examined and analyzed. However, it must be mentioned that both the sample and/or the population examined from the three different burial contexts are not representative of the entire living population of these highland sites (Milner *et al.* 2000; Wood *et al.* 1992).

LOCATION	EXCAVATION and CUT NUMBER	"RANDOMLY" SELECTED BAG NUMBERS	"SELECTED" BAG NUMBERS	BURIAL LOCATION
Marcahuamachuco	63H12	Unknown, 2, 3, 4, 5, 6, 7, 7b, 7c		Wall Burial
Marcahuamachuco	63H14	30		Wall Burial
Marcahuamachuco	63H15	Unknown		Wall Burial
Marcahuamachuco	63H17S	2		Wall Burial
Marcahuamachuco	63C1		11	Wall Burial
Marcahuamachuco	63Q3		55, 59	Castillo
Cerro Amaru	64A2		1, 2, 19	Mausoleum
Cerro Amaru	64A6		6, 56	Mausoleum
Cerro Amaru	64A7		3, 18, 23, 28, 30, 34, 36, 37, 41, 45, 49, 52, 54, 59, 61, 64, 65, 68, 73, 78, 81, 82, 85, 90, 93, 94, 96 and 100	Mausoleum

Table 3.1: Location and context reference table.

3.2 Inventory

Modified from Dr. Andrew Nelson's personal research recording form, a standardized data sheet was created to allow data to be documented efficiently. The data sheet incorporated a skeletal inventory, age and sex determinations, stature formulae, bone pathologies, dental pathologies, cranial and postcranial metrics, and non-metric trait analyses (see Appendix A). Due to the fragmentary status of the skeletal remains, extensive commingling and differential packaging, i.e. some bones with the same proveniences were separated into several different bags; the skeletal recording forms were not conducive to the research conditions. Instead, the forms were used as a mnemonic device.

Observations were recorded in a notebook, with each skeletal element documented individually. Unidentifiable cranial, rib, long bone and unknown bone fragments were occasionally grouped together for ease of navigation. All bags were recorded separately, even if they originated from the exact same context. All observations, examinations and photographs of the skeletal remains were made and recorded by the author in July 2006, with the exception of two bags labelled 63C1=11. These bags were examined and photographed by the author, with Dr. T. Topic acting as a scribe.

A Panasonic Lumix DMC-TZ1 digital camera was used to take all photographs. Photographs were taken of all identifiable bones, using normal and macro settings where appropriate. With the exception of two bags, all photographs were taken outdoors, using daylight for illumination. Due to daylight limitations, the last two bags examined from 63C1-11 were illuminated for photography by a 60 watt bulb.

3.3 Identification

In conjunction with traditional standardized methodology used by human osteologists (Buikstra and Ubelaker 1994), the human bones from Marcahuamachuco and Cerro Amaru were identified by less widely accepted methods, in an attempt to compensate for the conditions of the skeletal remains. Each bone was assessed on an individual basis, even if it was related to another skeletal element in the sample. This approach was based on the methodology used in the analysis of the skeletal remains from the Moatfield ossuary (Pfeiffer 2003:164), since a definitive relationship could not be established between different skeletal elements. The only exception was the human burials underneath the Castillo at Marcahuamachuco, which was treated as one adult and one fetus. The nature of the data collection is described below.

3.3.1 Human Vs. Non-human Identification

All skeletal elements were confirmed as human, with non-human elements removed from the human bag and labelled separately. In instances where the fragments were too small and/or water damaged to be diagnostic, they were recorded as human only when they were recovered from an area with identifiable human remains.

3.3.2 Identification

Due to the highly fragmentary nature of most of the skeletal remains, where possible the bones were categorized as cranial, long-bone or rib fragments. The larger elements were identified and sided, when applicable, with the aid of White and Folkens (2005). Only the larger, identifiable bones were analyzed with more scrutiny. If possible, age, sex, stature, etc. were determined, to better understand the individuals who were interred, aid in demographic profiling and provide information for future research on the individuals who died at Marcahuamachuco and Cerro Amaru.

3.4 Cranial/Postcranial Metrics

Where viable, cranial and postcranial measurements were taken based on the definitions and landmarks outlined and synthesized for adult humans in Buikstra and Ubelaker (1994), which were adapted from Moore-Jansen *et al.* (1994). Postcranial maximum length measurements of juvenile long bones were also recorded to compare to Scheuer and Black's (2000) age estimation charts. All cranial and postcranial measurements were taken using standard osteometric equipment and recorded in millimetres. Adult long bone maximum lengths and tibia total length were converted to centimetres for ease of input into the revised del Angel and Cisneros' (2004) stature formulae. Since measurement of the adult long bones can provide an estimate of living stature based on mathematical formulae, close attention was paid to these elements.

3.5 Determination of Biological Sex

Since there are still no acceptable morphological or metric standards accepted by osteologists or forensic anthropologists to assess the sex of sub-adults (Buikstra and Ubelaker 1994; Saunders 1992), the present section refers only to adult sex determination methods. Sex was determined through morphological characteristics and/or the use of metrics when remains were incomplete or poorly preserved (Safont *et al.* 2000; van Vark and Schaafsma 1992). The methods are complementary and provide similar levels of accuracy (Acsádi and Nemeskéri 1970; Buikstra and Mielke 1985; El-Najjar and McWilliams 1978; Krogman and Isçan 1986; Meindl *et al.* 1985; Rogers 1999; Safont *et al.* 2000; Stewart 1979; van Vark and Scaafsma 1992).

3.5.1 Morphological Determination of Sex

A common generalization in human osteology is that on average males are more robust, with more pronounced muscle attachment sites comparable to females (Bass 1995; Schwartz 1995). However, physical activity and lack thereof can affect robusticity and muscle markings, making supposedly male attributes appear on female skeletons, and vice versa. This problem is especially prevalent in Andean populations, where there exists only subtle sexual dimorphism. This point was illustrated in the original sex determinations conducted on the Machu Picchu highland collection, where Eaton (1916) concluded that the skeletal population was almost exclusively female. Upon re-evaluation, Verano (2003a) proved that the original determinations were faulty, and that the true sex ratio was relatively balanced.

Sex determinations based on the morphology of the skull were analyzed using the scoring system in Standards (Buikstra and Ubelaker 1994: Figure 4; after Acsádi and Nemeskéri 1970: Figure 16). The greater sciatic notch (Buikstra and Ubelaker 1994) was used to estimate the sex of the os coxae. The humerus was analyzed morphologically to determine sex, following the methodology outlined by Rogers (1999). Her method utilizes five different characteristics of the distal humerus: trochlear constriction, trochlear symmetry, olecranon fossa shape, olecranon fossa depth and the angle of the medial condyle. Each trait was scored, with the final sex designation based on the majority, i.e. more female to male characteristics or vice versa.

There are several inherent biases within these morphological analyses. First, due to the amount of commingling, fragmentation and water damage, all sex determinations were based on a single skeletal element/feature. Second, when it comes to older individuals, there is a tendency for the skull of males and females to exhibit more 'masculine' characteristics (Buikstra and Ubelaker 1994; Meindl *et al.* 1985 White and Folkens 1991). Third, many of the sex specific traits were developed using modern, largely 'White' European samples. They were not created for ancient indigenous populations, such as the highland Peruvians of Marcahuamachuco and Cerro Amaru.

3.5.2 Metric Determination of Sex

Metric methods, which rely on measurements and discriminant function equations, were also used in the determination of sex. Most methods are multi-factorial and often require several different skeletal elements (Giles and Elliot 1963; Holman and Bennet 1991; Isçan and Miller-Shaivitz 1984; Steyn and Isçan 1998). However, a few methods require only the presence of a single bone or measurement, and were beneficial for the commingled, fragmentary collections of Marcahuamachuco and Cerro Amaru (González-Reimers *et al.* 2000; Holland 1986; Black III 1978; Safont *et al.* 2000; Trancho *et al.* 1997)

For the purposes of sex determination, the only cranial measurements utilized in discriminant function analyses were the foramen magnum length and breadth. These measurements were chosen because of the higher incidence of intact occipital bones. The two measurements were input into the discriminant function formula outlined in Holland (1986).

Long bone shafts were prevalent in the skeletal sample recovered from Marcahuamachuco and Cerro Amaru. Several metric methods were used to determine sex, i.e. Black III (1978), González-Reimers *et al.* (2000), Safont *et al.* (2000) and Trancho *et al.* (1997). Safont *et al.*'s (2000) metric equations required the circumference of the ulna, the femur at the midshaft, and the tibia at the site of the nutrient foramen (NF). Based on their research, Safont *et al.* (2000) reported that the functions produced by a single circumference measurement achieved accuracies greater than 80% in different ancient populations. Safont *et al.* (2000:325) state that "it remains clear that ancient populations can be more easily classified with these functions than contemporary samples, probably because all ancient groups experienced similar lifestyles based on trading, agriculture, and animal husbandry". In the most general sense, this would have been a lifestyle shared by the inhabitants at Marcahuamachuco and Cerro Amaru, thereby making the discriminant functions more applicable due to their reference population.

The Black III (1978) functions utilized the midshaft circumference. As with the Safont *et al.* (2000) equations, the metric formulae are based on the premise that female individuals will have thinner bones than men; since, the thickness of the bone in men is the direct consequence of the greater deposition of subperiosteal bone (Black III 1978;

Frisancho *et al.* 1970; Garn 1970; Ruff and Hayes 1983; Safont *et al.* 2000). From the single metric measurement, Black III (1978) reported a correct classification rate of 82% for females, and 87.7% for males.

The original Black III (1978) equations were created for a small fragmentary cemetery population in Southeast Missouri. Black III (1978) also tested the method on the First Nations archaeological population from the Libben site. If current theories in regards to the Bering land bridge and the peopling of the New World are correct, the First Nations sample should be more genetically similar to Andean populations than they are to European or African populations. Assuming that sexual dimorphism has not drastically changed through the generations nor has the population diversified, the metric methods created for North American First Nations populations should have more applicability for Andean skeletal samples than ones created on/for European or African populations.

The Trancho *et al.* (1997) discriminant functions required four measurements: maximum epicondylar breadth; maximum head diameter; sagittal sub-trochanteric diameter; and the transverse sub-trochanteric diameter. Trancho *et al.* (1997) reported an accuracy of 99.1% for functions combining the measurements of the transverse diameter and the epicondylar breadth, and an accuracy of 98.47% for functions combining the sagittal sub-trochanteric diameter and the epicondylar length. When possible the aforementioned equations were used for the present study, otherwise, the discriminant functions which provided the next highest reported accuracy were used.

The tibia was also assessed metrically to determine sex with the González-Reimers *et al.* (2000) equations. The González-Reimers *et al.* (2000) function utilized the transverse diameter at the nutrient foramen. This function performed incredibly well on the Prehispanic Canary Islands' population for which the formulae were created. The accuracy ranged from 95.6 to 97.8% in males and 100% in females. However, when the method was tested on the Prehispanic population of El Hierro, the accuracy dropped to 50 – 75% for males and 80 – 100% for females (González-Reimers *et al.* 2000).

Although metric analyses of sex are included in this report, there are inherent biases that should be stated and/or reiterated. First, none of the aforementioned discriminant functions were created on or for either a Peruvian highland population or an Andean sample. Each author states explicitly that the methods should be used only on a comparable geographic/ancestral population (Black III 1978; González-Reimers *et al.* 2000; Holland 1986; Safont *et al.* 2000; Trancho *et al.* 1997). There exists so much variation within the human species that it is understandable that one population will not be the same as another. It should not be expected that populations will remain static temporally. Similarly, most of the metric methods used were created on modern 'White' European or 'Black' African populations and have never been tested on ancient archaeological samples. If the metric methods were created with an archaeological sample, the discriminant functions or morphological traits were based on populations with unverifiable sex determinations.

Richman *et al.* (1979) demonstrated that the side of the limb did not affect the sex determination; therefore, it should not be necessary to assess the right and left sides of the body individually. This is particularly important since the sample size from Marcahuamachuco and Cerro Amaru is limited due to fragmentation and poor preservation. In an attempt to compensate for some of these internal biases, a pilot study was completed by the author using data collected by Dr. Nelson from the Peruvian archaeological sites of Pacatnamu and San Jose de Moro (see Table 3.2 and Appendix B). The individuals used in the pilot study were relatively complete, with sex determined via various morphometric criteria. The different metric methods were then tested against measurements from the Pacatnamu and San Jose de Moro sample and compared to the original skeletal sex assessment. With the exclusion of the foramen magnum metric technique[3], accuracy for the sex determination on the basis of measurements of the long bones ranged from 67% to 89% correctly identified. Laterality does not appear to significantly affect the accuracy of the sex assessment. Therefore, the metric methods were deemed useful for the purposes of determining sex of the Marcahuamachuco and Cerro Amaru skeletal samples.

3.6 Age Determination

Age estimations can provide valuable insight into individuals who were interred vis-a-vis the demographics of the site, status, and burial customs. Age estimations can be

[3] The results from the foramen magnum metric technique on the skeletal sample from Pacatnamu and San Jose de Moro may be inaccurate, as several of the skulls exhibited intentional cranial modification.

Site Affiliation	Bone	Side	Measurement(s)	Discriminant Function Methodology	(n) Sex Deter. Consistent with Morph. Assess.	(n) Sex Deter. Inconsistent with Morph. Assess.	% Correct ID
Pacatnamu	Tibia	Right	Circumference at NF	Safont *et al.* (2000)	7	1	87.5
Pacatnamu	Tibia	Left	Circumference at NF	Safont *et al.* (2000)	6	1	85.7
San Jose de Moro	Tibia	Right	Circumference at NF	Safont *et al.* (2000)	8	2	80.0
San Jose de Moro	Tibia	Left	Circumference at NF	Safont *et al.* (2000)	4	4	50.0
Pacatnamu	Tibia	Right	Transverse Diameter at NF	González-Reimers *et al.* (2000)	6	2	75.0
Pacatnamu	Tibia	Left	Transverse Diameter at NF	González-Reimers *et al.* (2000)	5	2	71.4
San Jose de Moro	Tibia	Right	Transverse Diameter at NF	González-Reimers *et al.* (2000)	7	4	63.6
San Jose de Moro	Tibia	Left	Transverse Diameter at NF	González-Reimers *et al.* (2000)	9	1	90.0
Pacatnamu	Femur	Right	Bi-condylar Length /Max. Head Dia.	Trancho *et al.* (1997)	6	2	75.0
Pacatnamu	Femur	Left	Bi-condylar Length/ Max. Head Dia.	Trancho *et al.* (1997)	6	1	85.7
San Jose de Moro	Femur	Right	Bi-condylar Length/ Max. Head Dia.	Trancho *et al.* (1997)	10	1	90.9
San Jose de Moro	Femur	Left	Bi-condylar Length/ Max. Head Dia.	Trancho *et al.* (1997)	11	1	91.7
Pacatnamu	Femur	Right	Midshaft Circumference	Black III (1978)	4	2 (1 was Indeterminate)	66.7
Pacatnamu	Femur	Left	Midshaft Circumference	Black III (1978)	3	2 (1 was Indeterminate)	60.0
San Jose de Moro	Femur	Right	Midshaft Circumference	Black III (1978)	6	3	66.7
San Jose de Moro	Femur	Left	Midshaft Circumference	Black III (1978)	8	2	80.0
Pacatnamu	Femur	Right	Midshaft Circumference	Safont *et al.* (2000)	4	2	66.7
Pacatnamu	Femur	Left	Midshaft Circumference	Safont *et al.* (2000)	2	3	40.0
San Jose de Moro	Femur	Right	Midshaft Circumference	Safont *et al.* (2000)	8	1	88.9
San Jose de Moro	Femur	Left	Midshaft Circumference	Safont *et al.* (2000)	8	2	80.0
Pacatnamu	FM	N/A	FM Length/Breadth	Holland (1986)	1	4	20.0
San Jose de Moro	FM	N/A	FM Length/ Breadth	Holland (1986)	2	6	33.3

Table 3.2: Synthesized results from mini Pilot Study – Testing Metric Sex Determination Methods on a Peruvian Skeletal Sample from Pacatnamu and San Jose de Moro (see Appendix B for the actual measurements).

Note: FM stands for Foramen Magnum and NF stands for Nutrient Foramen.

hindered through environmental stressors, climatic conditions and health, as these stressors can affect how a person ages skeletally. As Loth and Işcan (1994:392) state, "One of the many elements that make adult age assessment particularly difficult is the great variation that exists in the aging process itself as well as in how it is reflected in the human body". Ideally, the entire skeleton should be examined to assess age, but this simply was not plausible with the commingled and fragmentary skeletal samples from Marcahuamachuco and Cerro Amaru.

Like the determination of sex, there are a variety of different methodological techniques to determine the age of a skeleton. These techniques were created for different skeletal populations, which differ both temporally and spatially from the samples from Marcahuamachuco and Cerro Amaru, i.e. skeletal collections created from modern autopsied individuals, and archaeological populations.

The first two age criteria observed in this study, were evidence of epiphyseal fusion for younger individuals and/or evidence of osteoarthritic changes that characterize older individuals. With the exception of the burial under the Castillo, commingling and fragmentation hindered the analysis, making it impossible to observe skeletal changes both post-cranially and/or cranially. Epiphyseal fusion was used to provide the general age of juveniles and young adults, since different areas of the body fuse at different rates. The presence of osteoarthritis tends to indicate an older adult, strenuous and repetitive activity can cause stress to the bone in younger individuals as well (Ortner 2003). Thus, care was taken when drawing final age conclusions.

Age determination of the skull/cranial bones, was determined from both cranial suture closure and analyses of the teeth. Typically cranial sutures fuse with increasing age; however, there is considerable variability in the rates of closure (Lynnerup and Jacobson 2003; Hershkovitz *et al.* 1997; Masset 1989). The amount of cranial suture closure was scored utilizing the methodology outlined in Buikstra and Ubelaker (1994) for the endocranial and ectocranial sutures, as well as the palatal sutures when they were available. Age estimation was derived primarily from the latero-anterior cranial sutures.

In order to determine age from dentition, two separate analyses were completed on the Marcahuamachuco and Cerro Amaru skeletal samples. First, eruption patterns were recorded, paying particular attention to antemortem tooth loss, deciduous dentition and adult dentition. They were then correlated to 'normal' dental eruption sequences found in White and Folkens (2005), which were adapted from Ubelaker (1989). Antemortem tooth wear patterns were also scored to estimate age from the dentition. The attrition patterns were compared to an age estimation chart created from a Libben First Nations skeletal population (Lovejoy 1985). None of the mandibles could be confirmed as a match to the maxillary dentition; therefore, the upper and lower dentitions were all scored individually.

The sternal rib end was assessed for age using the Isçan *et al.* (1984a, 1984b, 1985) and the Isçan and Loth (1986a, 1986b) phase analysis. The method was chosen since numerous studies have indicated that the different rib phase morphologies are recognizable and transferable across populations both spatially and temporally (Yavuz 1998; Loth 1995; Loth and Isçan 1994, 1995; Dudar *et al.* 1993; Russell *et al.* 1993; Saunders *et al.* 1992). The rib phase method was originally created for the fourth sternal rib end. Later studies concluded that age could be accurately assessed from both right and left ribs three to nine using the established standards (Isçan *et al.* 1989; Yoder *et al.* 2001:227). Therefore, even though the ribs assessed in the current study could not be accurately identified as the fourth right rib, phase analysis was still utilized for the only two complete ribs recovered in the skeletal sample from Marcahuamachuco and Cerro Amaru.

Where applicable, age determinations of the os coxae were based on the Suchey-Brooks pubic symphysis scoring system, published in Buikstra and Ubelaker (1994). Due to preservation limitations that prevented definitive sex determination via the os coxae, age ranges for both males and females were included.

To allow for ease of classification and to ensure greater inclusivity, age was broken down into seven different age categories: (1) Fetal; (2) Juvenile 0 – 19 years; (3) Juvenile/Young Adult – for bones that maintained characteristics of both age cohorts; (4) Young Adult 20 – 30 years; (5) Middle Adult 30 – 40 years; (6) Old Adult 40+ years; and (7) Adult, which encompasses any bone that lacks any distinguishing age determination features, but appears to have reached 'normal' adult size. Although the age ranges are broad and inclusive, the purpose of this study was to provide as much detail as possible, even if determinations were based on a single criterion.

3.7 Stature Estimation

An individual's achieved living stature is affected by a combination of environmental and genetic agents, making it a complex human trait (Kemkes-Grottenthaler 2005:340). According to a recent study by Hirschhorn *et al.* (2001) genetics account for approximately 75 to 90% of a person's overall stature, thereby making environmental stressors relatively minor contributors. However, growth and development studies that focus on long bone growth as a proxy for nutritional deficiency and childhood neglect (Steckel 1995; Saunders and Hoppa 1993) have illustrated a definitive link between reaching full growth potential and adequate health and longevity of life (Kemkes-Grottenthaler 2005; Steckel 1995).

Due to the fragmented nature of the skeletal collection, only twenty-one long bones were complete enough to allow living stature to be estimated. The estimates were made using the revised del Angel and Cisneros (2004) equations based on the original Genovés (1967) formulae. The del Angel and Cisneros regression formulae were chosen because: (1) The equations were developed using an indigenous Mesoamerican sample population; (2) All other stature estimation methods currently available utilize different ancestral populations, such as "White European", "Black African" and North American First Nations; and (3) The equations are the most widely accepted and used stature regression formulae in Andean studies. The intent was to limit potential error created from population variability.

For all long bones that were complete, the maximum lengths or total length (for the tibia) were measured using standard osteometric equipment. The measurements were then inserted into the del Angel and Cisneros (2004) formulae to estimate stature[4]. For incomplete long bones, standardized measurements of adult long bones were taken based on the landmarks outlined by Wright and Vásquez (2003), see Appendix C. Their measurement sites were closely followed from those originally defined by Steele (1970). In their study, Wright and Vásquez (2003) created long bone length estimations for incomplete long bones from a population of one-hundred modern rural Maya skeletons

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[4] The overall comparison of stature with other Peruvian populations is affected by the use of differing formulae. Since most of the stature estimates for Peruvian populations were published prior to the del Angel and Cisneros (2004) article, i.e. Murphy (2004) and Verano (2003a), they are based on the misuse of the Genovés' (1967) formulae, as they did not correct for living stature.

from forensic exhumations of clandestine cemeteries. The Maya sample used by Wright and Vásquez (2003) was more comparable to Peruvian skeletons than the original sample used by Steele (1970), thereby making the Wright and Vásquez (2003) method more applicable.

The landmarks in Wright and Vásquez (2003) were useful since the majority of the long bones recovered were pieces of the shaft only. Measurements from the nutrient foramen were added when visible, because some of the muscle attachment sites were hard to distinguish due to cortical bone damage from weathering. The measurements were then keyed into the regression formulae to estimate the length of the long bone. Once either the maximum or total length was obtained, the values were inserted into the del Angel and Cisneros (2004) formulae to calculate an approximate living stature of the individual.

3.8 Non-Metric Traits

Cranial non-metric traits have replaced the traditional bio-distance studies of cranio-metrics in the evaluation of evolutionary relations and biological affinities among and between different archaeological samples (i.e. Sutter and Mertz 2004; Blom 1998; Ishida and Dodo 1997; Lahr 1996; Prowse and Lovell 1996; Guillén 1992; Konigsberg 1988, 1987; etc.). Since non-metric cranial traits can be scored on highly fragmented skeletal remains (Sutter and Mertz 2004:134), a non-metric trait analysis was completed for all identifiable cranial and mandibular fragments. The observance of the various non-metric traits was based on the definitions and localities outlined in both Buikstra and Ubelaker (1994) and Hauser and De Stefano (1989). Detailed macro photographs were taken to ensure a visual representation was available for future reference. Due to the lack of comparative data available and the small number of observable traits, all the raw data have been compiled in Appendix D.

3.9 Pathology and Health

Palaeopathology is defined as the scientific study of disease, health and nutrition and their effects on the human and nonhuman skeleton (Ortner 2003). Pathological conditions typically only manifest skeletally if the individual had a chronic condition.

Individuals with acute illnesses normally die before the pathogen expresses itself on the bone or they recover, leaving osteological signals of their occurrence, which are only visible radiographically. Researchers characteristically rely on macroscopic description and observation of the changes witnessed in the skeleton to aid in the diagnosis of a particular disease (Roberts and Manchester 1995).

For this study, any bone anomalies were descriptively recorded and visually documented with a digital camera. A final pathological diagnosis was subsequently made with the aid of Ortner's *Identification of Pathological Conditions in Human Skeletal Remains* (2003). Due to the nature of bone growth and remodelling sequences, bone has a very limited reaction to infection and nutritional deficiencies. It can create more bone through osteoblasts, destroy bone via osteoclasts, alter shape, or combine these responses. Therefore, numerous diseases can have similar manifestations on the bone, making diagnosis difficult or impossible (Roberts and Manchester 1995). Therefore, all differential diagnoses were considered.

3.10 Minimum Number of Individuals

An important piece of information that human osteologists attempt to determine when commingled remains are encountered is how many individuals are represented in the assemblage. To overcome this challenge, the skeletal remains must be observed and sorted according to age, sex, and size characteristics. Secondary characteristics such as bone colour, taphonomic processes and the integrity of the remains may also be utilized in the sorting of individuals (White and Folkens 2005).

Once the osteological evidence is organized, the simplest way to assess the number of individuals recovered from within a burial context is to calculate the minimum number of individuals, or MNI. The MNI, adapted from zooarchaeological studies, represents the smallest number of individuals that would have been required to generate the recovered/sampled number of skeletal elements.

Many researchers credit White (1953) with the first use of MNI in relation to archaeological abundance studies (Adams and Konigsberg 2004). Adams and Konigsberg (2004) explain that physical anthropologists (i.e. Ubelaker 1974; Willey 1990) tend to almost exclusively focus on the calculation of MNI as the best way to quantify the number of individuals represented by commingled skeletal elements. In some instances, MNI may not provide the best representation of the skeletal remains, as it may not be able to provide an accurate estimate of the original number of individuals represented in the burial context (Adams and Konigsberg 2004). According to Fieller and Turner (1982:56) "the very presence of un-matched bones indicates that the MNI estimate is necessarily an underestimate of the number comprising the death assemblage".

Adams and Konigsberg (2004) argue that more accurate methods are available to assess the number of individuals represented by the skeletal material, i.e. the Lincoln Index (LI) and the most likely number of individuals (MLNI). LI estimates the *original* number of individuals deposited in the osteological death assemblage, even when taphonomic biases have destroyed any skeletal evidence of some individuals. In contrast, the MLNI attempts to estimate the most likely number of individuals that could have created the commingled skeletal assemblage, based only on the skeletal elements recovered (Adams and Konigsberg 2004). Unlike MNI, these two methodologies were developed to compensate for taphonomic processes, thereby providing a more realistic and accurate reconstruction of the death population.

Unfortunately, these more accurate methods of estimation are not applicable to the highly fragmented and poorly preserved skeletal material analyzed in this thesis. According to Adams and Konigsberg (2004:150):

> If fragmentation is extensive or preservation is extremely poor, so that accurate pair-matches are impossible to determine, the LI and MLNI are prone to miscalculations due to the multiplicative nature of the procedures. In this situation, no method (save for analysis of bone counts by maximum likelihood[5] with its own stringent data requirements) can provide accurate estimates of original populations.

Therefore, the author chose to use the MNI estimate since it was the only viable method available.

To determine the MNI of the assemblage, the procedural logic outlined in White and Folkens (2005:339) was followed. This included:

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[5] For a description of the methodology and the necessary requirements to perform the assessment see Rogers (2000).

- Removing all the non-human elements.
- Analyzing and separating the bones according to element and side.
- Counting and determining the MNI represented by the right hand side of the element, taking into account primary characteristics such as age, sex and robusticity, as well as secondary characteristics, such as taphonomy.
- Performing the same task on the left side of the bones, being cognizant of primary and secondary characteristics.
- Checking and determining if some of the left-side bones possibly do not match those recovered from the right. This is accomplished mainly through the differentiation between size and robusticity of the left and right bones. The left-side bones that do not match the corresponding right-side elements in either age or morphology are added to the MNI count.
- If right and left sided skeletal elements are not present in any capacity or are outnumbered by unpaired bones, the count is determined from the unpaired skeletal remains.

Once the aforementioned steps were taken, the MNI was recorded separately for each location and/or level. For instance, the MNI was taken for the Cerro Amaru mausoleum as a whole and for each of the three cists found inside the mausoleum. However, it should be noted, that for MNI to provide meaningful data, it requires the assumption that the skeletal remains represents the complete context/population. This inherent bias complicates the understanding of the two different niched halls (63C and 63H), as they are admittedly only a sampling of the interior of the buildings. Although all the skeletal material was analyzed from 63Q3, the understanding of the skeletal remains recovered from under the Castillo could be biased by incomplete recovery, i.e. the excavation was not expanded due to time constraints and safety concerns from the extensive depth below datum. In contrast, the MNI data from inside the mausoleum at Cerro Amaru should provide the most meaningful results since the entire mausoleum was excavated and all of the skeletal remains were examined and analyzed.

3.11 Taphonomy:

As previously stated, for the purposes of this thesis, taphonomy refers to all the modifications the bone has undergone from the time of death of the individual to the time of the author's analysis. These alterations can range from damage to the cortical bone via water to disarticulation from human modification. The skeletal remains excavated at the sites of Marcahuamachuco and Cerro Amaru were heavily affected by a variety of taphonomic processes. Although some bones are preserved exceptionally well, i.e. the remains recovered from underneath the Castillo, most of the collection is poorly preserved and fragmented. Similar taphonomic conditions have also been found at the site of Callejon de Huaylas, which is just south of Huamachuco (Paredes *et al.* 2000).

To better understand the processes that affected the bone from the death of the individual until the time of analysis, taphonomy was split into two distinct categories, non-cultural and cultural modifications, whereby non-cultural bone modifications refer to processes that were not influenced by human behaviour. Refer to Table 3.3 for the inclusion criteria used to determine the taphonomic process that affected the skeletal element. All indications of taphonomic processes were visually assessed and documented by the author during the initial examination of the skeletal remains. They were recorded, photographed, and entered into the subsequent database.

3.12 Data Analysis

All information obtained from the analysis of the skeletal remains from both Marcahuamachuco and Cerro Amaru was entered into the Microsoft Office 2003 Edition of Access. Organizationally, the data were entered in the order that the skeletal material was analyzed. Currently, the collection has not undergone systematic cataloguing, so no catalogue numbers were recorded. From this point forward, if a particular bone is mentioned, the record number given to the skeletal element by Access will be the number used in identification.

Taphonomic Change	Taphonomic Category	Inclusion Criteria	References
Root Etching	Non-Cultural	Non-linear erratic lines etched onto the surface of bone	e.g. Haglund and Sorg 2002
Soil Staining	Non-Cultural	Bone takes on the colouration of its surrounding environment	e.g. Haglund and Sorg 2002
Bleaching	Non-Cultural	Bone is bleached white, with cortical flaking, splitting and cracking from extreme exposure	e.g. Haglund and Sorg 2002
Water Damage/ Freeze Thaw Cycle	Non-cultural	Cortical flaking, splitting, and cracking. Bone appears 'bark' like	e.g. Haglund and Sorg 2002
Rodent Gnawing	Non-Cultural	Numerous parallel grooves, all similar in size	e.g. Haglund and Sorg 2002
Carnivore Activity	Non-Cultural	Circular indentations (from canines) and destruction of the ends of long bones with exposure of the marrow cavity	e.g. Haglund and Sorg 2002
"Trowel Trauma"	Cultural	Cut marks/breaks will be lighter in colour than surrounding bone	e.g. Haglund and Sorg 2002
Warfare	Cultural	Healed fractures/cut marks and/or injury to single locale, i.e. head, arms or torso	e.g. Hollimon and Owsley 1994; Hutchinson 1996; Marques *et al.* 2000; Molleson 1991
Autopsy	Cultural	Linear cut marks on the sternum and/or ribs that run sagitally and/or removal of the calvaria	e.g. Molleson 1991; Start and Robertson 1998; Valentin and d'Errico 1995
Scalping	Cultural	Linear parallel cuts around the circumference of the cranium, with particular attention around the scalp line	e.g. Bridges 1996; Bueschgen and Case 1996; Owsley 1994
Decapitation	Cultural	Cut marks around the foramen magnum	e.g. Andrushko *et al.* 2000; Smith 1993, 1997; Verano 1995, 2001
Throat Slitting	Cultural	Transverse linear cut marks on the anterior portion of the cervical vertebrae	e.g. Cordy-Collins 2001; Smith 1997; Verano 1986, 2001; Zimmerman 1997
Dismemberment	Cultural	Cut/chop marks at the areas of major tendons and epiphyses	e.g. Blom *et al.* 2003; Green 1999; Pijoan and Mansill 1997; Verano 2001
Defleshing	Cultural	Cut marks at major muscle attachment sites, with cut marks more dispersed over the entire surface of the bone	e.g. Blom *et al.* 2003; Green 1999; Pijoan and Mansill 1997; Verano 2001
Burning	Cultural	Bone has charred appearance. In higher temperatures, bone can display differential colour staining ranging from blue to white	e.g. Haglund and Sorg 2002
Cannibalism	Cultural	Pot polish, under-representation of vertebrae, evidence of burning, peri-mortem fractures and anvil abrasions in conjunction with cut marks around epiphyses and/or muscle attachment sites	e.g. Turner and Turner 1999; White 1992

Table 3.3: Taphonomic indicators and their inclusion criteria

CHAPTER 4: RESULTS

Introduction

The skeletal collection recovered from Marcahuamachuco and Cerro Amaru presents numerous difficulties for physical anthropologists. The skeletal assemblages have suffered from different taphonomic forces, including: water, weathering, looting, farming, burning, disarticulation, dispersal and fragmentation. An unfortunate effect of these forces acting on skeletal material is the loss of valuable data about the individuals who were interred (Adams and Konigsberg 2004; Haglund and Sorg 1997, 2002). Therefore, it must be explicit from the beginning that there are certain limitations to the following analyses. The following chapter provides a brief summary of the osteological analyses.

4.1 Marcahuamachuco Wall Burials

The following section (4.1) contains the results from the analysis of the skeletal material that was originally interred within the walls of the niched halls of Marcahuamachuco. Analyses that were completed include metric and morphological sex assessment, age estimation, MNI estimation, stature determination, non-metric trait analysis, pathological and health analysis, and analysis of non-cultural and human-modified taphonomic processes.

4.1.1 Determination of Biological Sex

The following section provides both the morphological and metric results of the assessment of sex for the human skeletal remains taken from the archaeological contexts of 63H and 63C. As previously stated, each skeletal element had to be assessed independently of any other bone due to extensive commingling and fragmentation; therefore, the numbers do not accurately reflect the demographics of the site or the overall MNI.

To better understand the data from the structural complex that housed all the remains sampled from 63H, all morphological sex determinations based on skeletal elements recovered from a cut with a 63H designation, e.g. 63H12 or 63H14, have been grouped together. For a more detailed overview of sex determination see Appendix E.

1. Morphological Determination of Sex

Utilizing the morphological differences in the cranium, mandible, os coxae, and humeri, sex was assessed for 48 adult skeletal elements recovered from wall burials (see Table 4.1 and 4.2). Only five sex determinations were made on skeletal material recovered from 63H, compared to 43 estimates from 63C. This is due to both poor preservation and a smaller sample size of 63H relative to 63C.

	Cranial Morph.	Frontal Morph.	Mastoid Process	Mandible Morph.	Os Coxa Morph.	Humerus Morph.	Consensus MNI[6]
Female	0	0	0	0	0	1	2
Male	2	0	0	2	0	0	4

Table 4.1: Morphological sex determinations for 63H.

	Cranial Morph.	Frontal Morph.	Mastoid Process	Mandible Morph.	Os Coxa Morph.	Humerus Morph.	Consensus MNI
Female	1	2	5	1	2	1	5
Male	4	5	4	7	5	6	5

Table 4.2: Morphological sex determinations for 63C.

Very few Peruvian males would be considered large and robust when compared to other populations, but taken within the context of the collections from Marcahuamachuco and Cerro Amaru, subtle size differentiations were seen, especially in the size of the mastoid process (see Figure. 4.1). These findings are consistent with Verano's (2003a) sex analysis of the Machu Picchu skeletal sample.

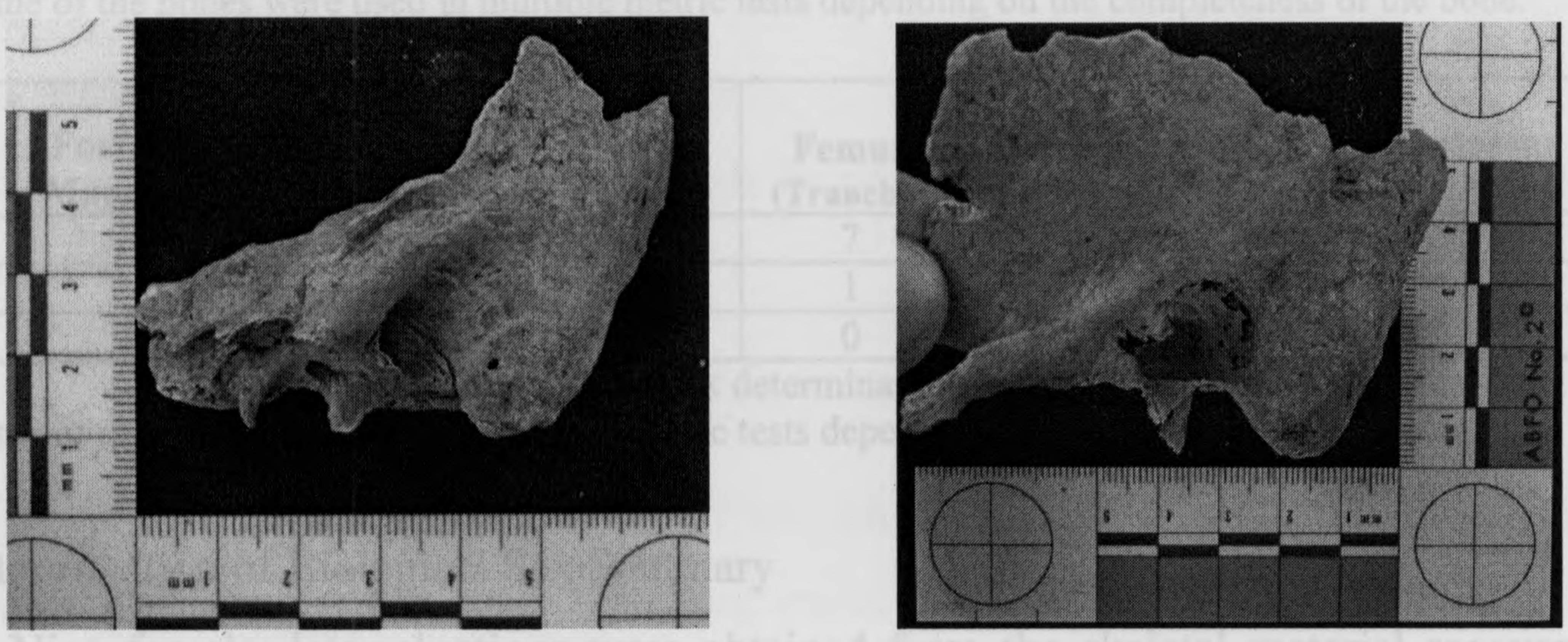

Figure 4.1: Figure on the left represents an example of a female mastoid process from 64A2. The Figure on the right represents an example of a male mastoid process from 63C1.

[6] The Consensus MNI represents an amalgamation of the total number of identifiable female and male individuals within the overall MNI. The total number of males and females in the Consensus MNI may not represent the overall MNI since the overall MNI contains juveniles and/or adults of undetermined sex.

2. Metric Determination of Sex

Wherever applicable, sex determinations were based on both morphological characteristics and metric measurements, with morphological assessments given a higher weighting. Both methodologies were used to increase the potential information obtained from the Marcahuamachuco archaeological samples. Since the skeletal elements were extremely weathered, poorly preserved and commingled, each bone was treated as a unique individual and assessed accordingly. Therefore, the total number of sex determinations does not directly correlate to the MNI or the demographics of the site.

The methods of metric sex determination were used for the occipital or occiput bone, ulna, femur and tibia, with no regard to laterality. The metric analysis proved very useful on the skeletal elements that were more fragmented and poorly preserved, providing an additional nine sex determinations for 63H and 23 for 63C1. See Tables 4.3 and 4.4 for a synopsis of the sex determinations provided per metric method. For a complete breakdown of the results from the metric analysis per bone, see Appendix E.

	Forman Magnum	**Ulna**	**Femur (Black)**	**Femur (Safont)**	**Femur (Trancho)**	**Tibia (Safont)**	**Tibia (Gonz-Reim)**	**Consensus MNI**
Female	1	0	4	4	2	3	3	2
Male	0	0	1	1	0	0	0	4
Indet.	0	0	0	0	1	0	0	0

Table 4.3: Metric sex determinations for 63H.
Some of the bones were used in multiple metric tests depending on the completeness of the bone.

	Forman Magnum	**Ulna**	**Femur (Black)**	**Femur (Safont)**	**Femur (Trancho)**	**Tibia (Safont)**	**Tibia (Gonz-Reim)**	**Consensus MNI**[7]
Female	2	4	4	6	7	6	6	5
Male	2	0	1	0	1	1	1	5
Indet.	0	0	1	0	0	0	0	1

Table 4.4: Metric sex determinations for 63C.
Some of the bones were used in multiple metric tests depending on the completeness of the bone.

3. Determination of Biological Sex Summary

Nine female determinations were obtained from the skeletal material recovered from 63H. Thirty-one female estimates were made from the material excavated from 63C1. Five male assessments were made from 63H, while 35 were made on material

[7] The MNI for 63C has been determined to be 13, which includes eleven adults and two juveniles. Table 4.4 only includes information for adults.

sampled from 63C1. In reality, when combined with the MNI, these numbers correspond to at least two females and four males sampled from 63H and five females and five males recovered from cut 63C.

The large difference in the number of male/female sex determinations are skewed by the number of skeletal elements sampled, i.e. a much larger amount from 63C compared to 63H. Preservation also played a significant role, since the more robust bones were used in the metric analysis and more material was poorly preserved and fragmented within the sample from 63H.

Since some individuals may have been more complete and therefore provided more skeletal material and therefore multiple sex determinations within the assemblage, an accurate understanding of the sites' demographics is impossible to obtain. It is clear, however, that there was no discrimination towards sex, since both males and females were interred inside the niched halls of Marcahuamachuco.

4.1.2 Age Estimation

The following section provides the results of age estimation for the human skeletal remains from the archaeological contexts of 63H and 63C. To better understand the demographics of the structural complex that housed all the remains sampled from 63H, all age determinations based on skeletal elements recovered from a cut with a 63H designation, e.g. 63H12 or 63H14, have been grouped together. Since each skeletal element had to be assessed independently of any other bone due to extensive commingling and fragmentation, the numbers do not accurately reflect the demographics of the site or the overall MNI.

1. 63H

As seen in Table 4.5, elements of six adult females, one male juvenile, two middle-age males and two older males were recorded in the skeletal sample from 63H. The remaining eighteen age assessments were conducted on individuals of unknown sex. Out of the 30 age estimations made on the skeletal sample taken from 63H, 23 fall in the adult category. The age estimations were based on size, robusticity, degree of epiphyseal fusion, presence/absence of osteoarthritic lipping, osteophytes and/or eburnation. The skeletal elements necessary for more accurate age estimations were often not preserved or recovered, i.e. the cranium, maxilla, mandible and pubis.

Age Range	Female	Male	Unknown
Fetal	0	0	0
Juvenile (0 – 19 yrs)	0	0	0
Juvenile/Young Adult	0	1	0
Young Adult (20 – 30 yrs)	0	0	0
Middle Adult (30 – 40 yrs)	0	2	0
Old Adult (40+ yrs)	0	2	2
Adult[8]	6	1	16

Table 4.5: Age estimation breakdown by skeletal elements recovered from 63H. Each record in the database was given an entry; thus, the information in the table does not accurately assess the demographic breakdown

Neither fetal nor juvenile bones are represented in the sample of 63H. Given the state of the collection, it is probable that the less dense and more fragile fetal and juvenile bones did not survive the taphonomic stressors to which they were subjected. The lack of fetal and juvenile bones can also be explained by differential burying customs, i.e. the fetal or juvenile remains could have been buried in a separate location/cemetery. The absence of young adults could have resulted from misclassification, i.e. labelled as 'juvenile/young adult' or 'adult'. Due to poor preservation, it is likely that identifying characteristics were obliterated.

In the sample from 63H, it is clear that the majority of the individuals were in the adult category. Utilizing the MNI data, it appears that there are skeletal elements belonging to at least one juvenile/young adult, two adult individuals, one mid-adult individual and two older adult individuals.

2. 63C1

The 65 age assessments based on individual skeletal elements for 63C1 range from juvenile to old adult. The only age group not represented in the assemblage were fetuses (see Table 4.6). Similar to 63H, the 'adult' category had the most age estimations, with approximately one-third of the age assessments from 63C1. Of the skeletal elements

[8] Even though individual teeth may have been categorized into the age category of 'adult' based on the fact that they represented adult dentition, they have been excluded in the overall age tabulations. Since there are potentially 32 teeth from each individual, the results would have been greatly skewed. This was done for all age estimation tables.

classified into the adult category, one individual was identified as female, 12 were identified as male and 13 were of undetermined sex. The juvenile category had one male and 14 individuals of unknown sex. The 'adult' and juvenile bias may have occurred for similar reasons as 63H, namely that the age assessments were based on size, robusticity, epiphyseal fusion and/or evidence of arthritis. In contrast, the other more specific age ranges required certain skeletal elements that were unavailable or too degraded for assessment.

Age Range	Female	Male	Unknown
Fetal	0	0	0
Juvenile (0 – 19 yrs)	0	1	14
Juvenile/Young Adult	1	2	4
Young Adult (20 – 30 yrs)	5	3	3
Middle Adult (30 – 40 yrs)	0	1	1
Old Adult (40+ yrs)	1	2	1
Adult	1	12	13

Table 4.6: Age estimation breakdown by skeletal elements recovered from 63C.
Each record in the database was given an entry; thus, the information in the table does not accurately assess the demographic breakdown

The juvenile/young adult[9] and young adult categories produced an additional 18 age estimations. Six elements were identified as female, five as male and seven of indeterminate sex. In contrast, only one male element and one element of unknown sex fell into the middle adult category. Only one female element, two male elements and one element of indeterminate sex were assessed as being older than 40 years. From these results, it would appear that more skeletal elements were recovered from younger individuals or simply that more young individuals were interred within the niched halls of 63C.

Even though it appears that a lot of skeletal material provided age information, in reality the overall MNI is only 13. It is apparent that the majority of the elements came from adult individuals. The assemblage represents bones from at least two juveniles, two juvenile/young adult individuals, and nine adults of varying ages ranging from young adult to older adult. Therefore, with the exception of fetal remains, age does not appear to

[9] This category was created especially for individuals whose cranial sutures were all considered 'open'. These individuals did not fit in the categories outlined in the methodology and were therefore considered as a cross between the juvenile and young adult age ranges.

be a discriminating factor when it came to being interred inside the walls of niched Hall C.

4.1.3 MNI Results and Analysis

The analysis of the MNI of the wall burials was complicated by the variation and quantity of the skeletal elements recovered and examined. To better understand the data obtained from the determination of MNI, the results and analysis of the wall burials will be broken down into two categories: (1) samples from 63H; and (2) samples from 63C. The subdivisions are necessary, since the wall burial sample came from two separate Marcahuamachuco niched halls, approximately a kilometre apart (see Figure 2.6). All the excavations labelled under the 63H designation represent different cuts recovered from the same complex of structures. Since the elements recovered are from looted and disturbed contexts, it is possible that there is a crossover of individuals, i.e. the bones recovered from 63H14 could belong to an individual recovered in cut 63H12. Therefore, all of the various cuts from 63H have been lumped into a single unit for the purposes of determining MNI (see Table 4.7).

LOCATION	MNI (Based on Bone Overlap)	MNI (Incorporating Sex/Age Distribution)	BONE(S) USED FOR DETERMINATION
63H	4	6	Temporal (Modified by Mandible, Calvaria, Cranium, Femur and Tibia)
63C1	12	13	Temporal (Modified by Femur, Humerus, Calvaria, Mandible and Tibia)

Table 4.7: Table depicting the MNI for all samples taken from wall burials.

1. 63H

The MNI for 63H was six. Looking solely at overlapping skeletal elements, the MNI appears to be four, based on the number of temporal bones found in the 63H assemblage. A right and left temporal of unknown sex/age were recovered from cut 63H12, two intact temporals were recovered still articulated with a complete mid-adult male calvaria from cut 63H15, a left temporal was still articulated with a juvenile/young adult male cranium from 63H17 and two pieces of petrous portions from un-sided temporals were located in cut 63H17S.

Incorporating the age and sex distributions of the remains recovered from within the 63H designation, the overall MNI represents at least six individuals. Based on robusticity and dental attrition, a mandible recovered from 63H14 and calvarium from cut 63H15 likely belonged to a middle adult male(s). It is conceivable that the mandible located in 63H14 belonged to the same individual recovered from 63H15, since both skeletal elements belonged to middle adult males. However, no mandibular condyles were present, so this proposition could not be confirmed.

In the skeletal elements recovered from cut 63H17S a juvenile/young adult male cranium and an older adult male mandible were observed. An older adult mandible was also recovered from cut 63H12. Two right femora, two left femora and two left tibia were all determined to belong to adult females from 63H. Thus, the final breakdown for MNI from the 63H context appears to be two adult females, a juvenile/young adult male, a middle adult male, and two older adult males.

All three main areas of the human body, the skull, axial skeleton and appendicular skeleton, are represented. The sampled skeletal remains include everything from robust long bones, to fragile ribs and small elements such as the pisiform and different teeth. Due to the variety of the bones analyzed, at least one of the interments was likely a primary deposition.

2. 63C1

The MNI was determined to be 13. Of all the MNI assessments, 63C1 proved the most challenging due to the shear quantity of commingled and fragmentary bone recovered from this context. Nearly every bone in the human body was represented at least once in the sample from 63C1. Due to the wide range of skeletal material recovered, it is quite feasible that at least one interment was primary. The temporal, occipital, long bones and os coxae were the most frequently represented, aided by their size and robusticity.

Based solely on the number of left temporal bones that were sideable and identifiable, the MNI appeared to be twelve. The sample contained two left juvenile temporals, one temporal belonging to an adult of unknown sex or age, four adult female temporals, four adult male temporals and one temporal that appeared to have belonged to a juvenile/young adult male.

Incorporating the age and sex distribution, a final MNI of 13 was reached. Two temporal bones clearly belonged to juvenile individuals based on the diminutive size of the bones. Through the analysis of two calvaria, it was determined that both a male and female juvenile/young adult were present in the assemblage. Using metric analysis, femora belonging to two young adult females, and one young adult male were present in the sample. Using dental wear standards on several mandibles, it was determined that one middle adult female, one older adult female and two older adult males were also represented in the death assemblage. Bones develop and age at differing rates throughout life of an individual, and can combine varying degrees of 'masculinity' and 'femininity'. Thus, several individuals could have contributed multiple bones to different age and or sex categories – especially the 'adult' and 'unknown' categories. Keeping this in mind, the final MNI was based on the presence of two juvenile bones, two bones belonging to juveniles/young adults (one male and one female) and nine adults (four female, four male and one of undetermined sex).

4.1.4 Stature

The following section provides the results of the stature estimates for 63H and 63C1 using the del Angel and Cisneros (2004) equations. Since the sex determinations contained so many inherent biases, both male and female equations were calculated. Nineteen stature estimates were made on long bones collected from 63H and 63C1 (see Table 4.8). Similar to sex and age estimations, the total number of stature estimates does not accurately reflect the overall MNI since each estimate was based on a skeletal element that was assessed independently of all other skeletal elements.

The Highland site of Machu Picchu (Verano 2003a), has a male stature range of 148cm to 168cm and a female stature range of 138cm to 156cm[10] (see Table 5.1). Therefore, for the highland site of Marcahuamachuco, stature estimates that are less than 145cm are likely to be female, and those greater than 153cm are likely to be male. This

[10] These stature estimates are based on the original Genovés equations and have not been modified by the del Angel and Cisneros (2004) formulae.

ID #	Location #	Femoral Max Length (cm)	Tibia Total Length (cm)	Fibula Max Length (cm)	Humerus Max Length (cm)	Ulna Max Length (cm)	Radius Max Length (cm)	Stature Estimation Male[11] (cm)	Stature Estimation Female[12] (cm)
1*	63H12		30.51♀						144.3
2*	63H12	36.80♀							142.5
36	63H12				25.80				139.7
115	63H17S		33.40						152.1
118*	63H17S				30.39♂ 30.16♀			159.7	157.8
760	63C1					23.10		155.2	150.9
776	63C1				26.10			148.9	
777*	63C1				26.09♂			148.9	
778*	63C1				28.59♂			155.1	
780	63C1				26.35				142.0
783	63C1					21.40		150.8	144.1
784	63C1						23.00	159.6	157.2
791	63C1	37.80						149.4	
792*	63C1	32.69						137.8	131.9
794	63C1	37.80							145.1
795	63C1		31.00						145.6
798	63C1		30.40						144.0
800	63C1		33.10						151.3
801	63C1			30.60				152.8	146.0

Table 4.8: Table depicting the stature estimates for the adult human bones recovered from 63H and 63C.
Note: Stature estimations based on the Genovés (1967) method, using the revised regression equations modified by del Angel and Cisneros (2004).

* The maximum length or total length, of this bone has been estimated using Wright and Vasquez's (2003) regression formulae

[11] The calculation was made using the male (♂) maximum long bone length, or the total length in the case of the tibia, from the male formulae provided in Wright and Vásquez (2003). If the bone was complete enough for use in a metric formula of biological sex determination, only the estimate corresponding to the result of the sex determination was provided.

[12] The calculation was made using the female (♀) maximum long bone length, or the total length in the case of the tibia, from the female formulae provided in Wright and Vásquez (2003).). If the bone was complete enough for use in a metric formula of biological sex determination, only the estimate corresponding to the result of the sex determination was provided.

assumption will ensure that the stature data from Marcahuamachuco are not artificially inflated, and does not include the 'shortest' females in the male estimates, and the 'tallest' males in the female estimates

1. 63H

The first five stature estimates were provided for the 63H provenience. Since ID 118 falls above the female threshold of 153cm tall, the humerus likely belonged to a male individual. Thus the one male stature estimate for 63H was 159.7cm. The four remaining stature estimates provided a female range of 139.7cm to 152.1cm. The stature estimates were based on three different long bones. One estimate was provided using the maximum length of the femur, while the additional four estimates came from the total length of the tibia and the maximum length of the humerus, two and two respectively.

2. 63C1

The remaining 14 stature estimates were made utilizing the long bones recovered from 63C1. These estimates provided a wider range of statures. Since not all bones had their biological sex assessed metrically or morphologically, stature estimates were used to aid in the overall sex determination. Therefore, therefore ID 118 and 784 are likely males, while 792 is likely a female individual. Since ID 760, 783 and 801 have stature estimates that fall in the middle of the cut-off range, the sex of the individuals remains unknown.

The estimates provided a male stature range of 148.9cm to 159.6cm and a female stature range of 131.9cm and 152.1cm. These estimates were based on all the major long bones of the human body. Therefore, it is extremely likely that there is some overlap in the estimates, i.e. some of the estimates were made for the same individual using different bones from their body. For instance, ID 776 and 777 represent right and left humeri respectively. Both these bones have similar morphology and robusticity. Once stature was calculated it is evident that the bones likely belonged to the same male individual since the stature estimates are identical at 148.9cm.

4.1.5 Health and Pathology

The following section describes the different palaeopathological specimens recorded in the sampling of 63H and 63C1. This section has been broken down into several inclusive categories: trauma, degenerative joint disease, dental disease and skeletal stress indicators.

1. Trauma

From within the skeletal remains sampled from 63H and 63C1, six individual cases of trauma were observed (see Table 4.9). The incidents included a possible case of blunt force trauma to the forehead, a possible trepanning episode and four examples of healed fractures.

- 63H

The only incident of trauma observed in the skeletal collection recovered from 63H, was a possible case of blunt force trauma to the frontal bone. There is a depression in the left frontal bone of the juvenile male (see Figure 4.2). No radiating fractures were present, indicating that the wound had likely undergone a significant period of healing and remodelling. The age and sex of the individual, combined with the location of the trauma[13] are consistent with individuals exposed to interpersonal violence and/or warfare (Hogue 2006).

ID	Location	Bone	Side	Sex Determination	Age Estimation	Trauma
87	63H17S	Cranium[14]	n/a	Male	Juvenile	Blunt Force Trauma
582	63C1	Calvarium	n/a	Male	Juvenile/Young Adult	Sharp Force Trauma
583	63C1	Calvarium	n/a	Male	Young Adult	Trepanation
672	63C1	First Metatarsal	Right	Unknown	Unknown	Healed Fracture
796	63C1	Tibia	Right	Male	Unknown	Healed Fracture
863	63C1	Fifth Metatarsal	Unknown	Unknown	Unknown	Healed Fracture
877	63C1	Clavicle	Right	Unknown	Unknown	Healed Fracture

Table 4.9: Incidents of trauma in 63H and 63C1.

[13] With the trauma on the left portion of the frontal, it is possible the individual was assaulted face to face by a right-handed individual.

[14] Although Figure 4.2 only displays the splanchnocranium, the larger cranial bones were present. The bones had separated at the coronal suture.

Figure 4.2: Possible blunt force trauma to frontal bone, cranial depression outlined with the circle, ID 87

- 63C

Of the at least 13 individuals interred within the confines of 63C, ID 582, a juvenile/young adult male displays a possible sharp force injury to the left parietal (see Figure. 4.3). The injury pierces the ectocranial surface, but does not penetrate through to the endocranial surface. The lesion is roughly 2.5 mm in diameter. There is no evidence of healing and the lesion and the surrounding bone are both stained the same colour. Therefore, this injury was likely not post-mortem and could have happened at or around the time of death of the individual, while the bone was still plastic. The wound could be consistent with a star-shaped mace that has been found in the Huamachuco area (Seed 2000). In addition to the potential of piercing trauma, a star-shaped mace (if swung with any force), would also have the potential to deliver terrible blunt force trauma; this does not appear to be the case with ID 582.

A possible case of trepanation was found in the calvarium of a young adult male, ID 583. The hole is located on the right parietal bone, which measures 13.24 by 13.13 mm (see Figure. 4.4). The ectocranial and endocranial surfaces both exhibited damage to the cortical bone from exposure to water. Post-mortem trauma related to taphonomic processes is excluded, since the colouration of the broken edges match the staining of the rest of the skull. The edges appear slightly bevelled, which could be consistent with the circular grooving method of trepanning (Nystrom 2007).

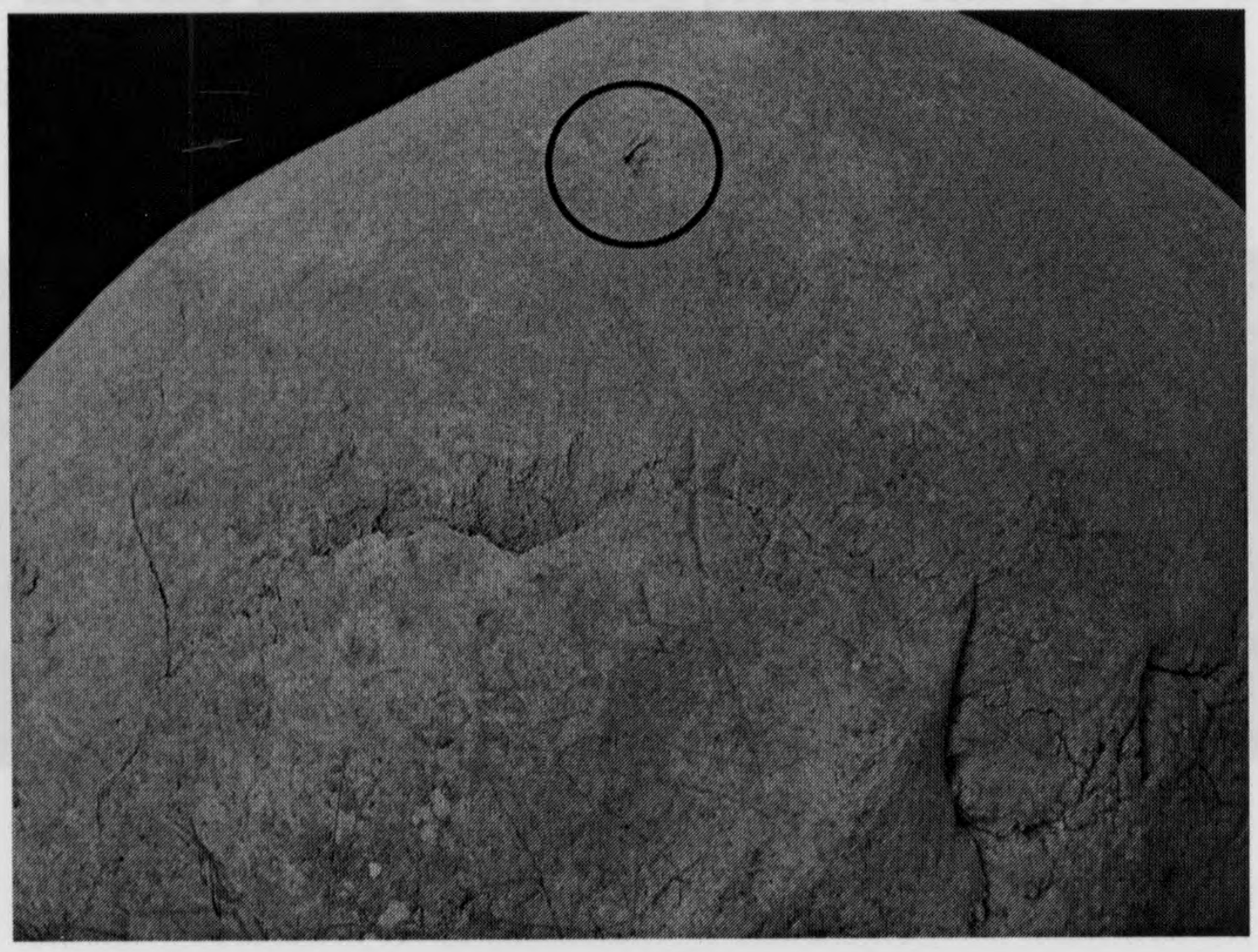

Figure 4.3: Possible sharp force trauma incident to the left parietal of ID 582, trauma outlined with a circle

Figure 4.4: Possible trepanning incident (indicated by arrow) to the right parietal ID 583.

Four examples of healed fractures were located in the sampling of 63C1. With the exception of one adult male, the sex and age distribution of the individuals is unknown. Two of the fractures were found on metatarsals, ID 672 and 863. These fractures were likely the result of an accident or accidents. ID 877 exhibited a fracture to the lateral end of a right clavicle. Breaking of the collar bone could have been the result of an accident or interpersonal violence. The final fracture appears to be a spiral[15] fracture of a right tibia, ID 796 (see Figure. 4.5). There is a faint visible line that runs acute to the long axis of the bone. Evidence of osteomyelitis on the anterior surface indicates that the fracture had succumbed to infection during the healing process. This type of fracture could have resulted from a fall or another type of accident.

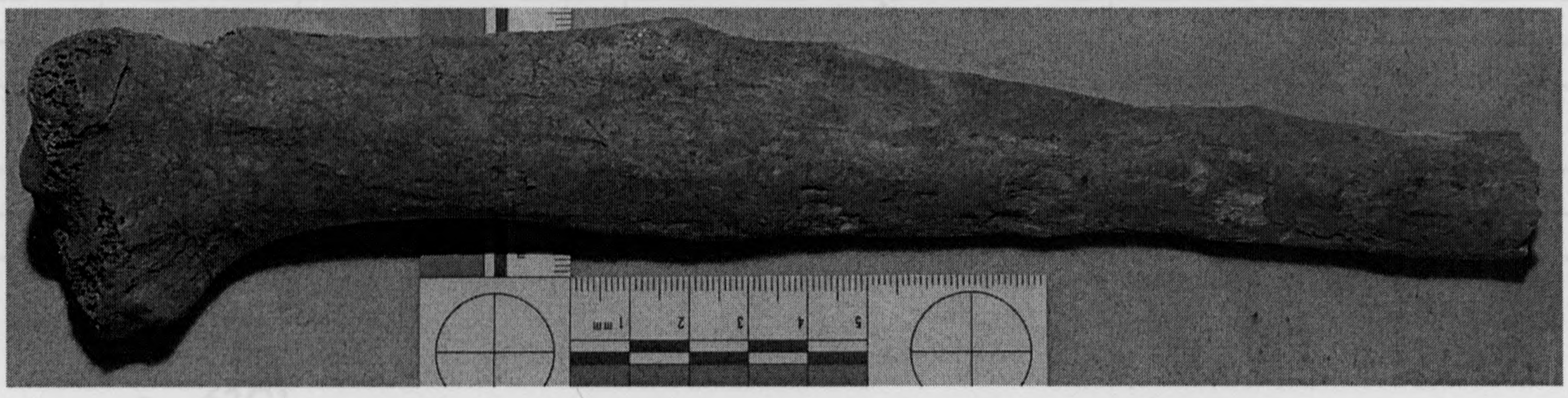

Figure 4.5: Healed fracture of the right tibia, ID 796.

2. Degenerative Joint Disease

The adult skeletons from 63H and 63C show little evidence of arthritic changes. Only five skeletal elements from 63H and three bones from 63C1 show some degenerative changes (see Table 4.10). The incidents were mainly confined to the bones of the vertebral column, with only three episodes of eburnation located in the appendicular skeleton, i.e. two metatarsals and a distal femoral articular surface.

- 63H

In the case of 63H, instances of eburnation were located on four skeletal elements. Shiny polished areas were observed on the left inferior articular facet of atlas and the left superior articular surface of axis, ID 30 and 48 respectively. The dens and the superior articular facets on axis also appear to be flattened (see Figure. 4.6). Since both of the vertebrae come from the same context, appear to articulate, and have opposing sites of eburnation, they likely belonged to the same older individual.

The only evidence of osteoarthritic lipping and osteophytic activity was located on an adult lumbar vertebra (see Figure. 4.7). This type of degeneration is characteristic

[15] To confirm this diagnosis, a radiograph should be taken.

of older individuals and individuals who subject their bodies to repetitive physical activities (Ortner 2003).

ID	Location	Bone	Side	Sex Determin.	Age Est.	Degenerative Joint Disease
30	63H12	Atlas (C1)	n/a	Unknown	Adult	Eburnation
33	63H12	MC1	Left	Unknown	Adult	Eburnation
41	63H12	Lumbar Vertebra	n/a	Unknown	Adult	Osteoarthritic Lipping and Osteophytic Activity
48	63H12	Axis (C2)	n/a	Unknown	Adult	Eburnation
117	63H17S	Femur	Right	Female	Adult	Eburnation
668	63C1	Thoracic Vertebra	n/a	Unknown	Adult	Osteoarthritic Lipping and Osteophytic Activity
890	63C1	Vertebra	n/a	Unknown	Adult	Osteoarthritic Lipping
924	63C1	Axis (C2)	n/a	Unknown	Adult	Osteoarthritic Lipping

Table 4.10: Skeletal elements that exhibit degenerative joint disease in 63H and 63C1.

- 63C1

All of the degenerative changes found in the skeletal material recovered from 63C1, were located in vertebral elements. Evidence of osteoarthritic lipping was observed on an axis, an unidentified vertebra and a thoracic vertebra. The thoracic vertebra also exhibited evidence of osteophytic activity. Since these three skeletal elements were sampled from the same provenience, and no overlap occurs, it is possible that all three of these skeletal elements belonged to the same individual.

Figure 4.6: Axis with evidence of eburnation on superior articular face (arrow) and flattening of the dens and right superior articular facet, ID 48

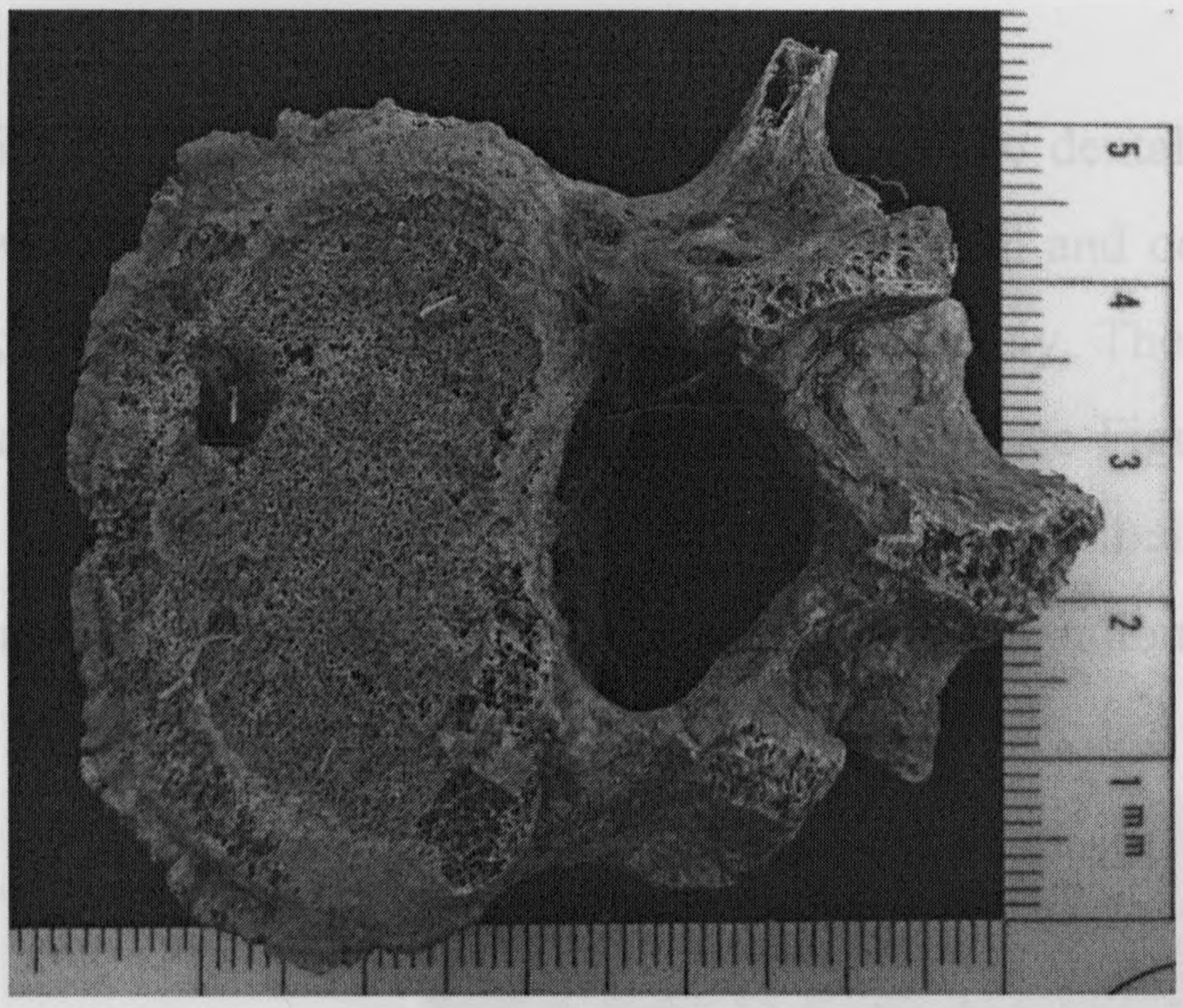

Figure 4.7: Osteoarthritic lipping and osteophytes of lumbar vertebra, ID 41.

3. Dental Disease

Dental disease afflicted individuals from both 63H and 63C1, with dental caries being the most common ailment (see Table 4.11).

ID	Location	Bone	Side	Sex Determin.	Age Est.	Dental Disease
49	63H12	Mandible	n/a	Male	Old Adult 40+ yrs	Caries
66	63H12	Molar	Unknown	Unknown	Adult	Caries
70	63H14	M2	Unknown	Unknown	Adult	Caries
83	63H17S	Mandible	n/a	Unknown	Old Adult 40+ yrs	Tooth Loss
578	63C1	Maxilla	Right	Unknown	Unknown	Abscess and Caries
581	63C1	Maxilla	Right/ Left	Unknown	Juvenile/Young Adult	Caries
590	63C1	Cranium	n/a	Female	Juvenile/Young Adult	Caries
604	63C1	Mandible	n/a	Male	Old Adult 40+ yrs	Tooth loss and Abscess
605	63C1	Mandible	n/a	Female	Old Adult 40+ yrs	Tooth Loss
606	63C1	Mandible	n/a	Male	Adult	Tooth loss and Caries
737	63C1	Mandible	Left	Male	Young Adult 20-30 years	Caries
739	63C1	Mandible	n/a	Male	Middle Adult 30-40 yrs	Caries
754	63C1	M3	Unknown	Unknown	Adult	Caries
755	63C1	M2	Unknown	Unknown	Adult	Caries
756	63C1	Molar	Unknown	Unknown	Adult	Caries
940	63C1	Maxilla	Right	Unknown	Juvenile	Abscess

Table 4.11: Skeletal elements and teeth that exhibit dental disease in 63H and 63C1.

- 63H

From the 63H skeletal sample, four out of five of the dental pathologies were carious lesions. Two of the lesions were located on the buccal and occlusal surfaces of loose molars found in the collection, ID 66 and 70 respectively. The other two lesions were located in the same older adult male mandible, ID 49 (see Figure. 4.8). The first lesion was located on the medio-buccal side of the right first mandibular premolar, while the second was located on the occlusal surface of the left third mandibular molar.

Figure 4.8: Carious lesion in adult molar, ID66.

The only other dental pathology found in 63H was antemortem tooth loss in an older adult mandible, ID 83 (see Figure. 4.9). During the individual's life, the second premolar to the third molar on both the right and left sides of the mandible were lost and the alveoli completely resorbed, with bone growth sealing the sockets.

- 63C1

Similar to 63H, the predominant dental ailment for 63C1 was carious lesions. Nine out of the 13 instances of dental disease showed some evidence of dental caries. Six of the carious lesions presented on the occlusal surface of the molars, with ID 755 and 756 having multiple caries. ID 606 had carious lesions on the buccal surface of three teeth. Buccal caries were also found on two teeth of mandible ID 737. A carious lesion was found on the mesial side of a second left mandibular molar, ID 739.

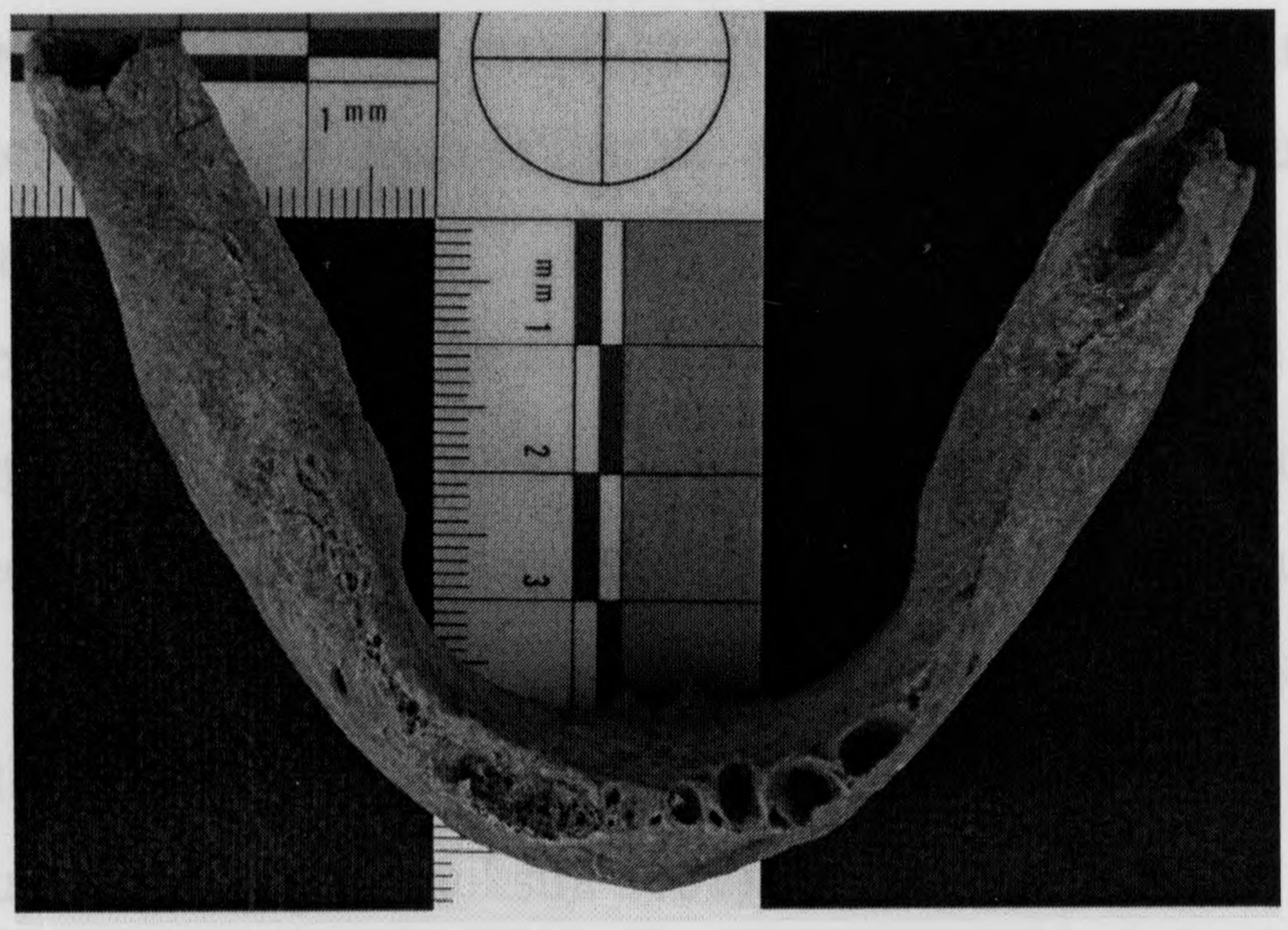

Figure 4.9: Antemortem tooth loss in older adult mandible, ID 83.

There were three instances of antemortem tooth loss and three cases of dental abscesses. ID 604 (see Figure. 4.10) and 605 were both older adults with all of their posterior teeth lost and the alveoli bone completely resorbed. The third instance, ID 606, had only lost the left first mandibular molar antemortem.

Figure 4.10: Abscess (circled) and antemortem tooth loss in older adult male mandible, ID 604

While carious lesions and tooth loss primarily affected the molars, abscesses were located around the premolars. ID 578 and 604 (see Figure. 4.10) had abscesses above/below their right second premolars, maxillary and mandibular respectively. ID 940 had an abscess above their left first maxillary premolar. The predominance of premolar involvement is likely biased by the fact that the posterior teeth were lost and completely resorbed antemortem.

Some of the antemortem posterior tooth loss and buccal caries found in both the skeletal assemblages from 63H and 63C could have resulted from excessive coca chewing. Due to commingling and fragmentation, none of the mandibular dentition could be paired with the corresponding maxillary dentition. Therefore, there was no evidence of the more diagnostic characteristics of heavy coca use, namely triangular root caries and severe root exposure (Indriati and Buikstra 2001).

4. Skeletal Stress Indicators

Possible evidence for childhood anaemia was observed in the human skeletal remains from 63H and 63C1. The evidence of this deficiency was found in the form of porous lesions on the cranial vault and the roofs of the eye orbits (see Table 4.12). Three instances of cribra orbitalia, a form of porotic orbital lesion, were observed in skeletal elements from 63H and 63C. All three cases showed evidence of healing.

ID	Location	Bone	Side	Sex Determin.	Age Est.	Skeletal Stress
23	63H12	Frontal	n/a	Unknown	Adult	Cribra Orbitalia
582	63C1	Calvarium	n/a	Male	Juvenile/Young Adult	Porotic Hyperostosis
610	63C1	Maxilla/Frontal	Right	Unknown	Unknown	Cribra Orbitalia
740	63C1	Frontal	n/a	Female	Unknown	Cribra Orbitalia

Table 4.12: Skeletal elements that exhibit skeletal stress

Only one juvenile/young adult male from 63C exhibited porotic lesions on the ectocranial surface of the cranial vault. The lesion is concave, compared to the surrounding bone. The centre of the lesion has a rough and undulating surface. The lesion is roughly oblong, measuring 48 by 34 mm (see Figure 4.11). The surrounding cortical bone is bumpy and rough. The entire posterior surface of both the right and left parietals are covered in small porotic lesions (see Figure 4.12). It is generally accepted that a combination of diet, infection and parasitic infection[16] can act together to cause anaemia

[16] In Precolumbian Peru, the vector for parasitic infections in humans was often fish (Nelson, personal communication). It should also be noted that the skull has not been intentionally modified, so the porotic lesions were not the result of cranial modification.

(Ortner 2003; Verano 2003a). It can therefore be concluded that this individual from Marcahuamachuco experienced periods of childhood stress during growth and development.

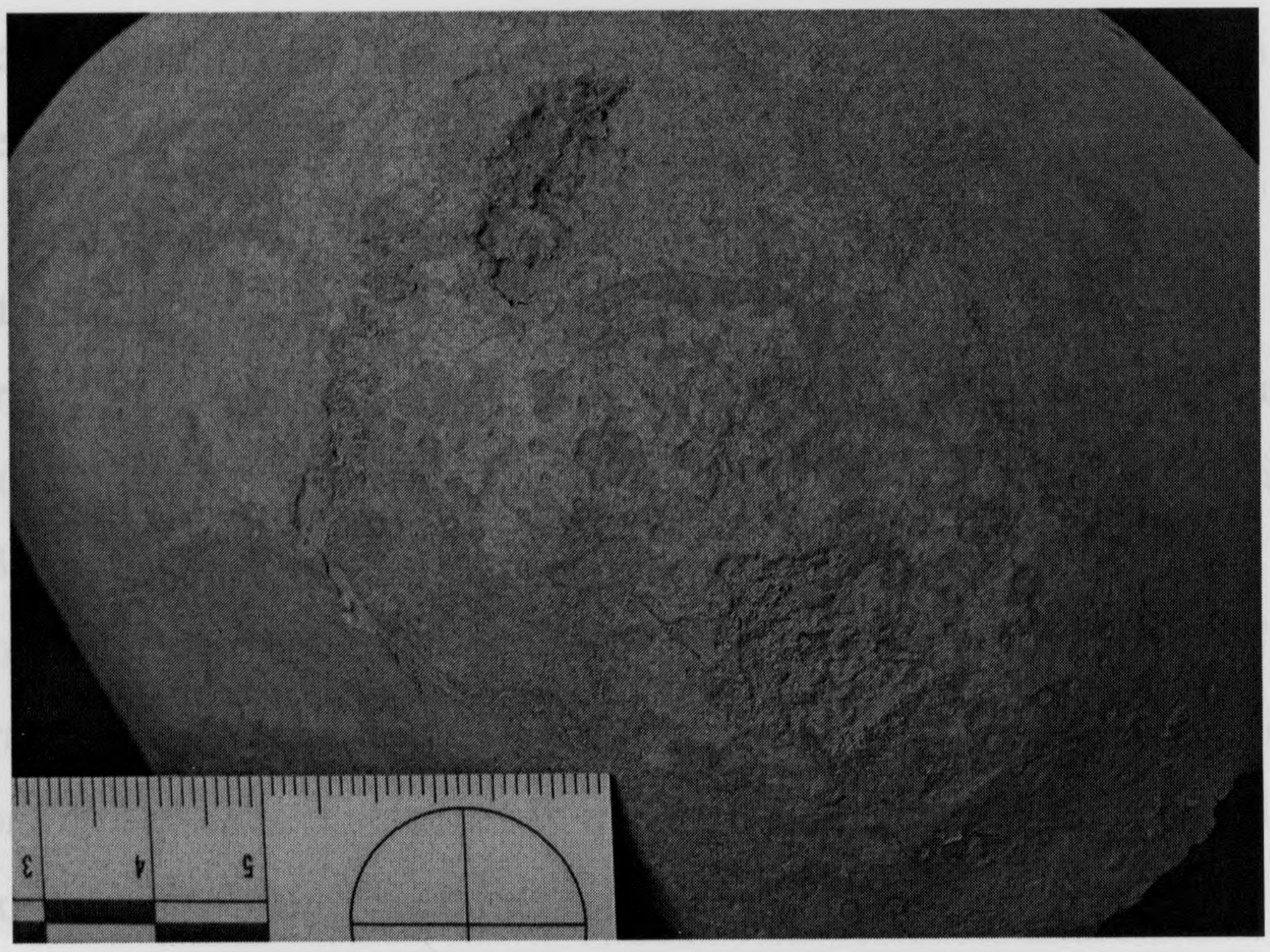

Figure 4.11: Pitting of the frontal bone, ID 582

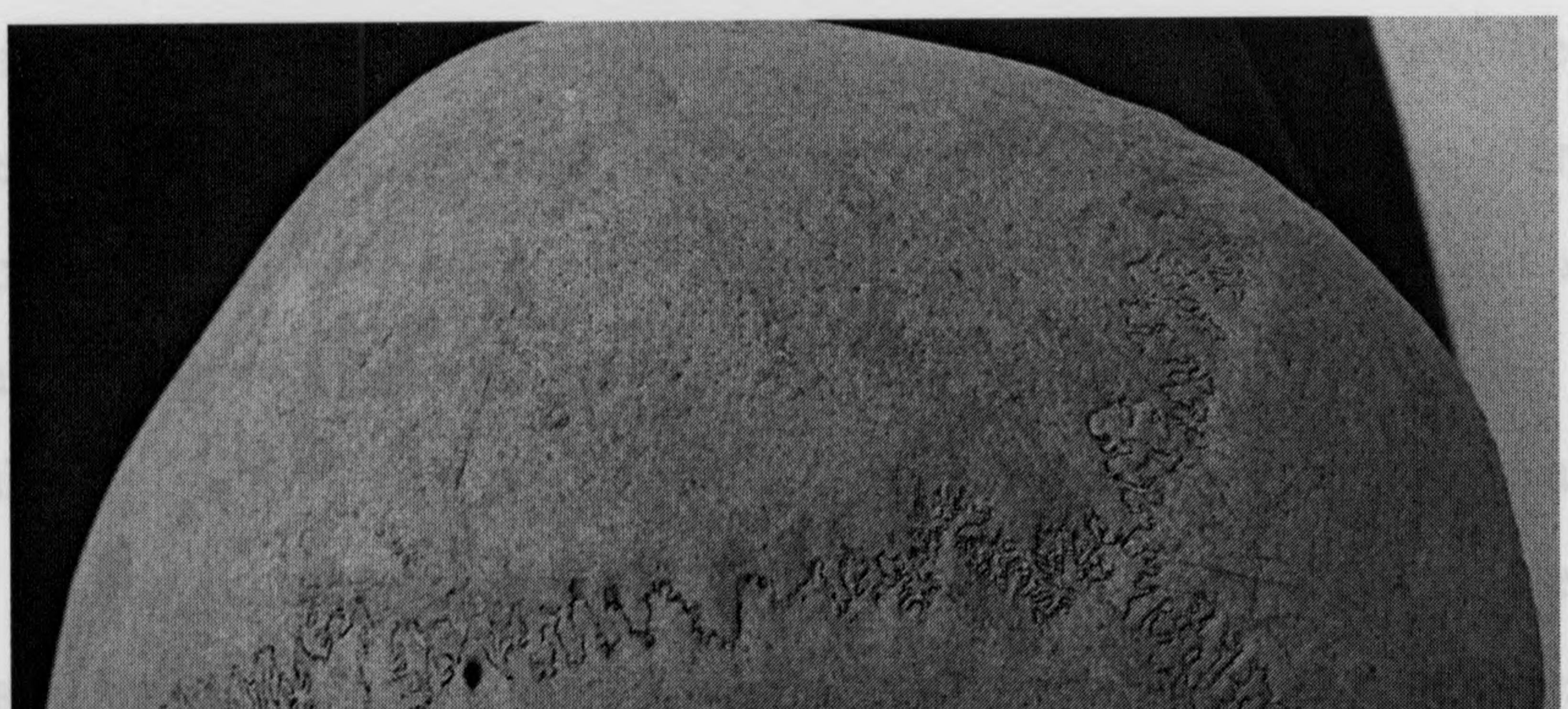

Figure 4.12: Mild porotic hyperostosis over the left and right parietals, ID 582

4.1.6 Taphonomy

The following section discusses the taphonomic changes that the bones in the skeletal samples of 63H and 63C1 underwent. The taphonomic analysis includes both non-cultural and cultural processes. Unlike other sections of analysis, 63H and 63C1 have been grouped as a single unit, to better understand the taphonomic processes that skeletal elements interred inside walls undergo.

1. Non-Cultural Taphonomy

Environmental and climatic conditions greatly affected the skeletal material interred in the walls of the niched galleries at Marcahuamachuco. As illustrated in Figures 4.13 and 4.14, water and weathering were the most influential taphonomic factors. Water/weathering greatly damaged the cortical bone of most of the skeletal material, erasing identifiable characteristics. These processes also aided in the fragmentation of the bones. The bones in most instances can be likened to pieces of bark, since they exhibited the same roughness and coarseness on their surfaces.

Since these skeletal elements were originally interred within walls, it can be assumed that the water damage likely resulted after the collapse of the walls, as the walls would have afforded some protection from the weather. However, when the graves were looted or the walls collapsed, they would have been exposed to the elements. If the looting or collapse had occurred in antiquity, the water would have had access to the skeletal remains for centuries.

The skeletal samples from 63H and 63C1 were not all completely water damaged, fragmentary and/or unrecognizable. Differential preservation rates ensured that some skeletal remains were very well preserved (see Figure. 4.15). The well-preserved bones display no evidence of sun-bleaching, water damage or root etching (see Figure 4.16). Hence, it is inferred that these human bones were not exposed to the elements for the same duration as the more taphonomically affected remains.

Rodent gnaw marks were found on ten skeletal elements from both 63H and 63C1 (see Figure. 4.17). The distinctive parallel grooves caused by the rodents' right and left central incisors distinguish these marks from either carnivore activity or human modification. The tooth impressions are recent since they are lighter in colour than the surrounding soil-stained bone.

Figure 4.13: Fragmentary and water damaged long bone fragments, 63 H17S.

Figure 4.14: Fragmented and water damaged ectocranial surface of a frontal bone, 63 C1

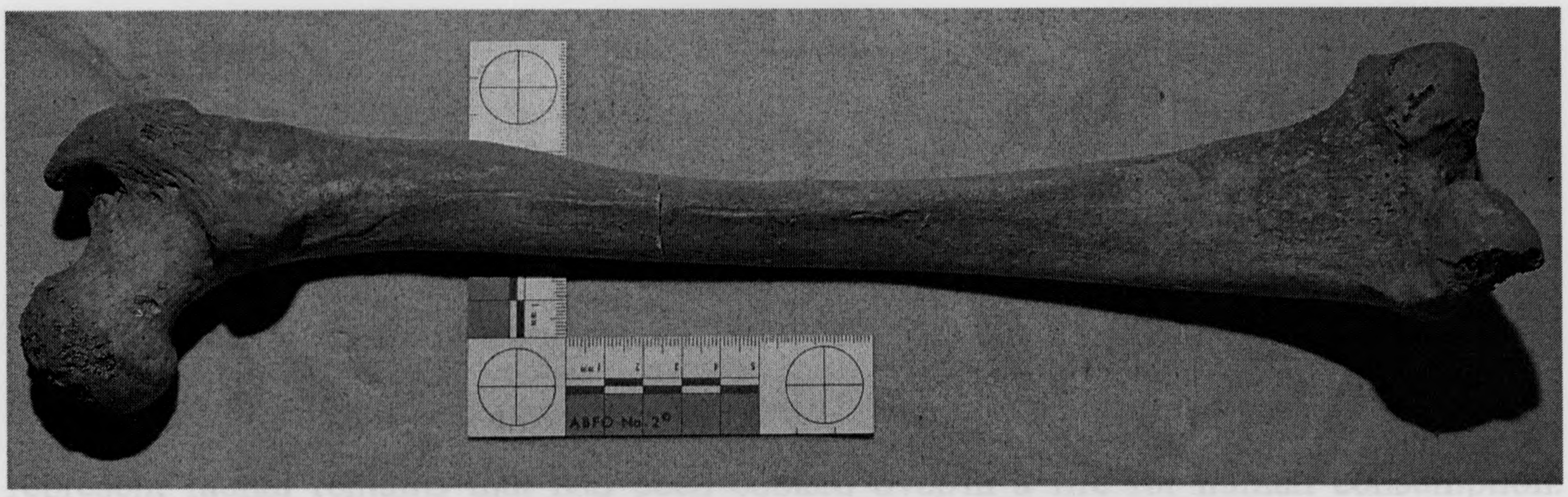

Figure 4.15: Posterior aspect of a complete right femur from 63C1 depicting good perseveration

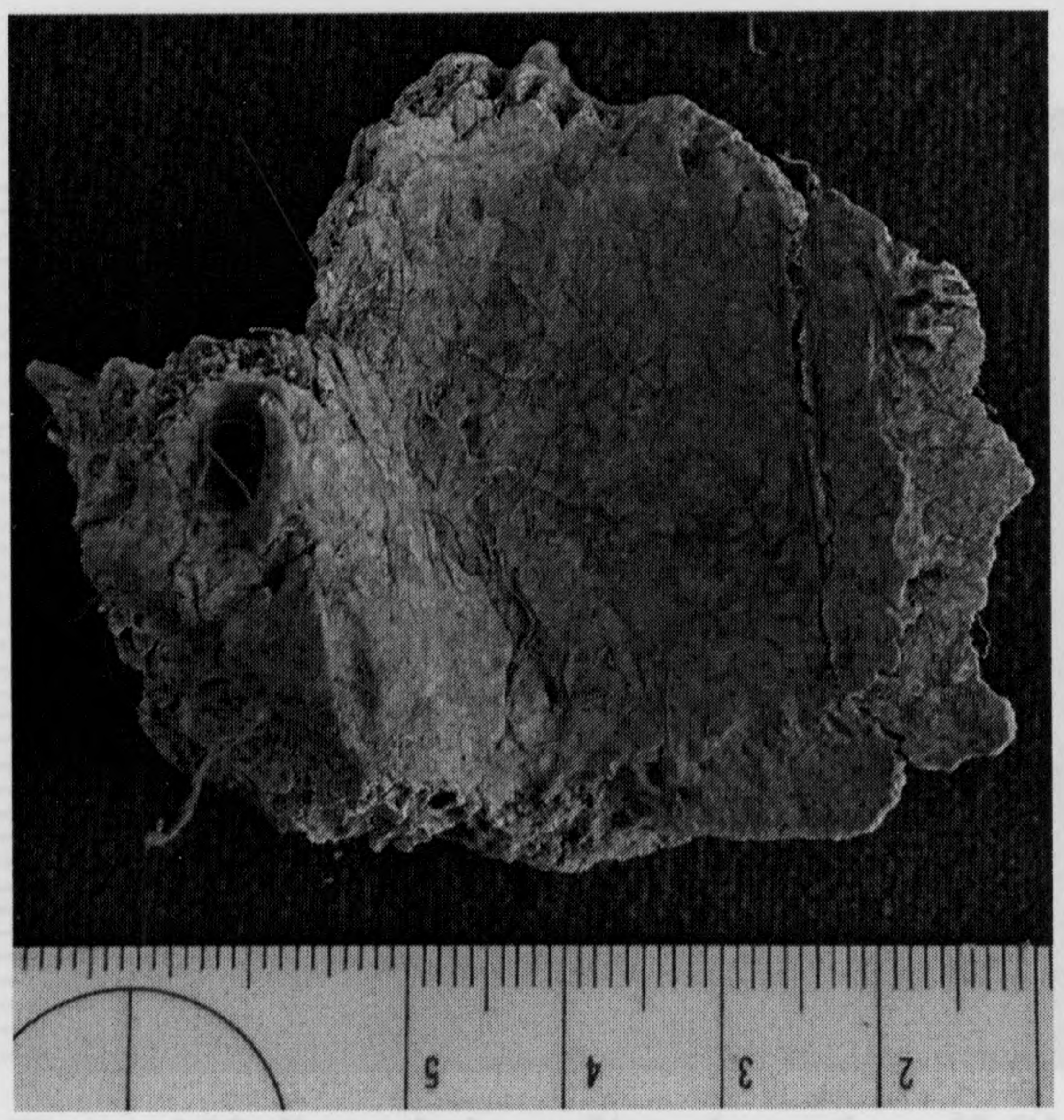

Figure 4.16: Extensive root activity, endocranial surface of a right temporal from 63H12

Figure 4.17: 'Recent' or post-excavation rodent gnawing, posterior aspect of the midshaft of a left femur from 63C1.

2. Cultural Taphonomy

Two bones recovered from the 63C1 context displayed evidence of having been exposed to fire. The bones were charred black with some whitening around the edges (see Figure. 4.18). Both these bones were fragmentary, with no identifying characteristics discernable. It is therefore possible that these bones are not actually human. They may represent faunal remains that had been cooked over/in a fire for human consumption. They also could have been the result of secondary deposition from another locale, since no other evidence of burnt remains has been located in the sample from 63C1.

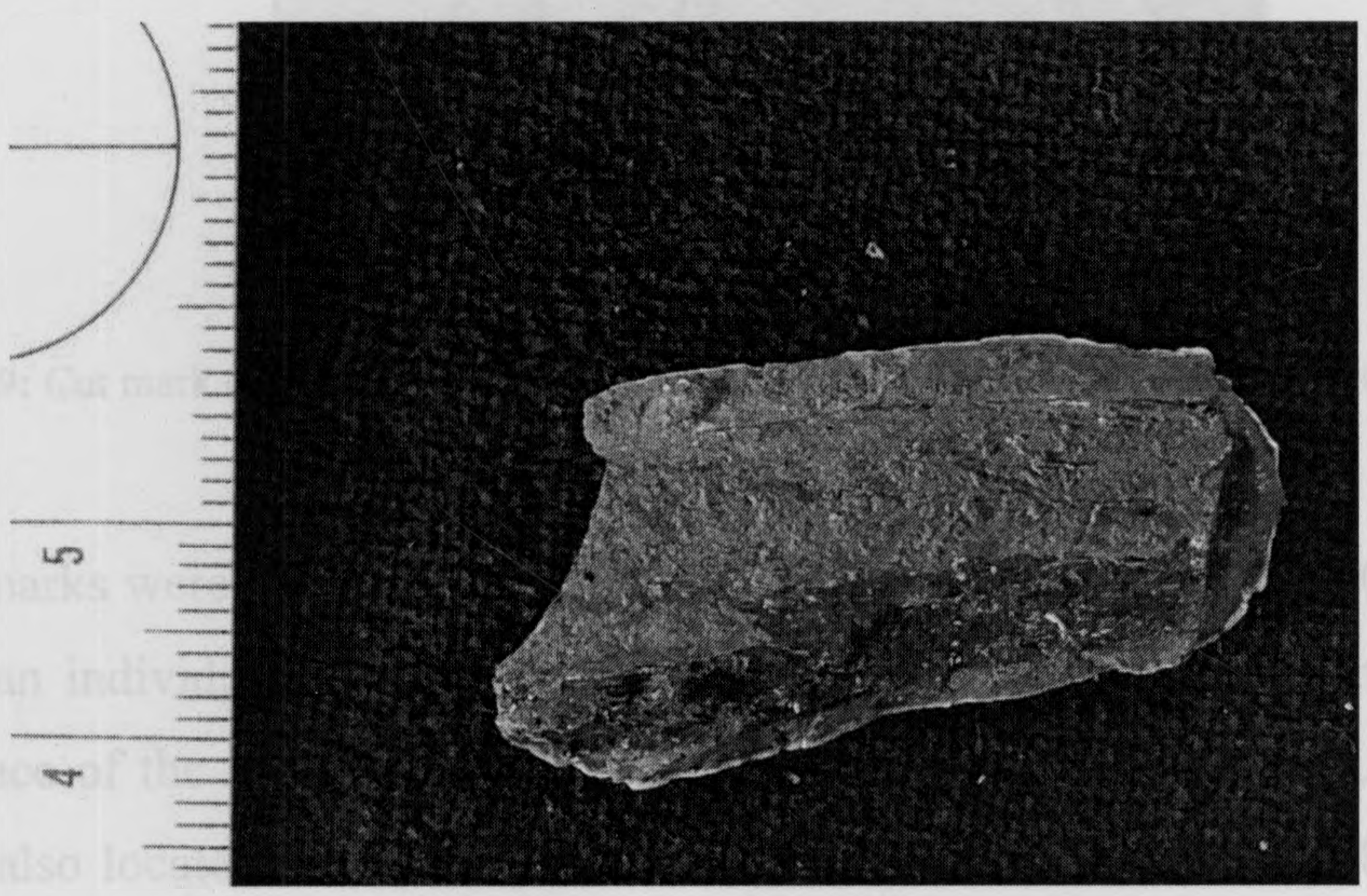

Figure 4.18: Burned piece of long bone, from 63 C1

A few skeletal elements from 63H and 63C1 displayed cut marks incised into the cortical bone (see Figure. 4.19). These marks were lighter than the surrounding bone, suggesting that the marks were made after extensive soil staining had already occurred. These marks are likely the result of "trowel-trauma", possibly created at the time of excavation and recovery

In addition to recent human modification, evidence for intentional human alteration near the time of death was also observed. Five long bone shafts from 63H (see Table 4.13) had parallel grooves incised into the cortical bone (see Figure. 4.20). Most of the marks were located at or around midshaft of the bone (see Figure 4.21). Four out of five of the long bones were assessed as belonging to adult females, while the last bone, ID 116, was identified as belonging to an adult male. These incisions are large with a rounded kerf floor, which is inconsistent with a knife wound.

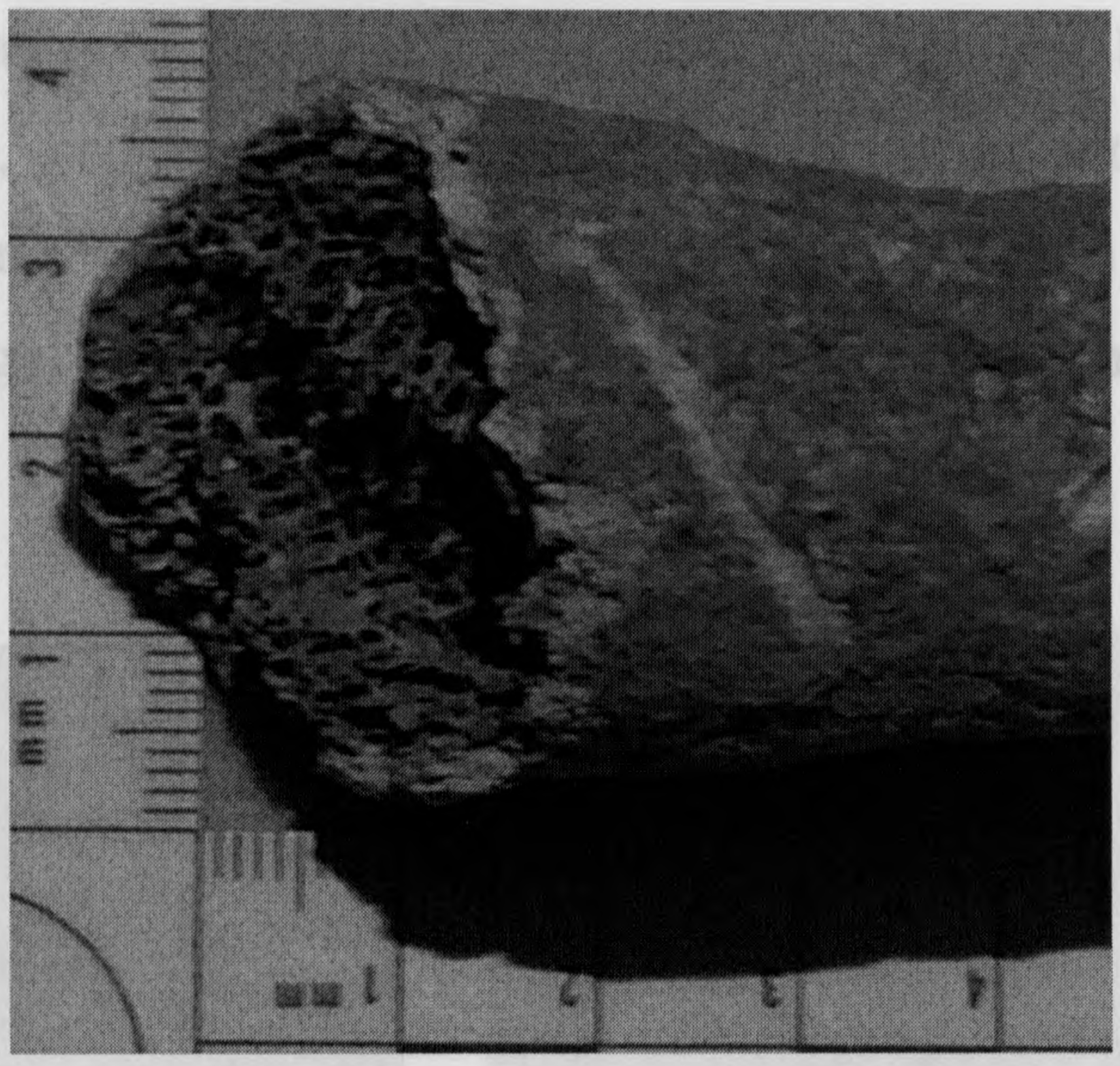

Figure 4.19: Cut mark on the medial aspect of the distal end of a left femur recovered from 63 C1.

Cut marks were also observed in the skeletal sampling from 63C1. One left adult clavicle for an individual of indeterminate sex, ID 876, had a large indentation on the inferior surface of the lateral portion of the bone (see Table 4.13 and Figure 4.21). Cut marks were also located on the calvaria of two individuals, ID 582 and 583 (see Table 4.13). Six cut marks were located on the frontal bone of ID 582, the longest of which is 10 mm (see Figure. 4.22). The marks are incised into the bone and are roughly parallel. The trauma appears consistent with a sharper implement. In contrast to the cut marks on the frontal of ID 582, the two marks on ID 583 are much larger, with a U shaped floor. These marks extend over a considerable portion of the calvarium, crossing several suture lines.

4.1.7 Summary of Wall Burials

Skeletal material recovered from the site of 63H came from at least five individuals, who consisted of: one juvenile/young adult male, two adult females, one middle adult male and two older adult males. No fetal or juvenile remains were present in the sample. There was one possible male stature estimate of 159.7cm. The four remaining stature estimates provided a female range of 139.7 to 157.8cm.

In regards to trauma and health, the sample from 63H had one incident of blunt force trauma, which was recorded in a young adult male frontal bone. There was evidence of eburnation, osteoarthritic lipping and osteophytic activity on several vertebrae, and eburnation on a femur and a first metacarpal. Carious lesions were the dominant dental pathology. There was also a mandible that exhibited ante-mortem tooth loss.

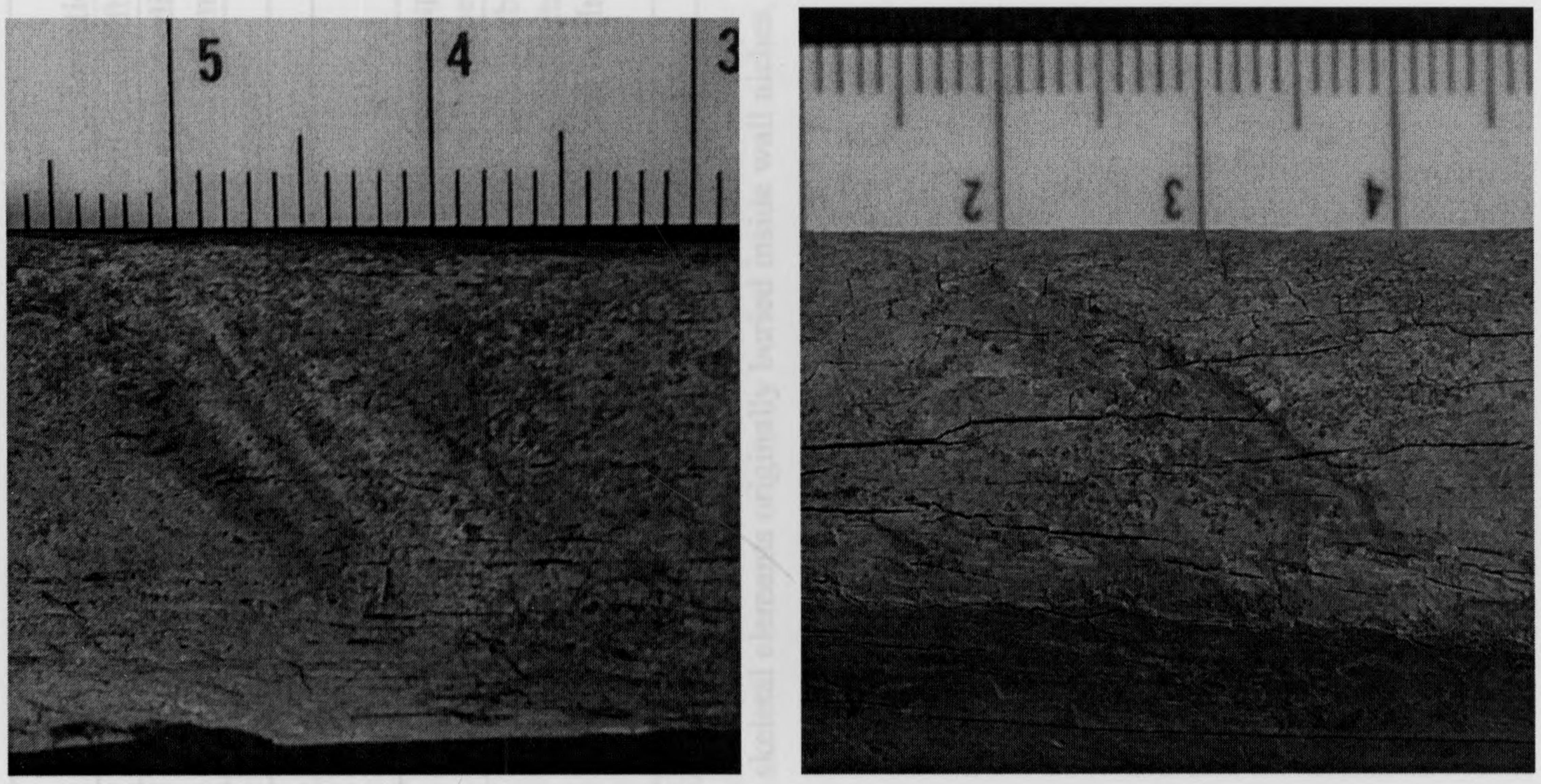

Figure 4.20: Parallel linear cut marks on the midshaft of a right femur and a left tibia, recovered from 63 H12 and 63 H17S respectively.

In contrast, there was a wider range of ages found in the larger sample of 63C. With a MNI of 13, the skeletal material represented at least two juveniles, a male and a female juvenile/young adult, one adult of unknown sex, four female adults and four male adults. Noticeably absent, were fetal remains. This finding is consistent with the age distribution found in 63H. Since not all bones that provided stature estimates were complete enough to determine biological sex, the stature estimates for 63C fell between 137.8cm and 159.6cm for males, and 131.9cm and 157.2cm for females.

ID	Location #	Bone	Side	Sex Determination	Age Estimation	Location of Cut-Marks
2	63 H12	Femur	Left	Female	Adult	Btw. lateral condyle and midshaft on lateral portion (2 cuts?).
14	63 H12	Femur	Right	Female	Adult	Approx. 2/3 down the shaft, medially moving superiorly at approx. 45 degree angle (16mm in length and 3.3mm wide).
115	63 H17S	Tibia	Left	Female	Adult	On shaft, 2-3 parallel grooves.
116	63 H17S	Femur	Left	Male	Adult	Just below midshaft.
117	63 H17S	Femur	Right	Female	Adult	Midshaft.
582	63 C1	Calvarium	N/A	Male	Juvenile or Young Adult	Several (6) cut marks appear superior to the frontal boss at the 'scalp line'. The marks are parallel to the supercilliary arches, with the longest = 9.95mm.
583	63 C1	Calvarium	N/A	Male	Young Adult 20-30 yrs	Several lines are etched into the bone - one along the sagittal suture across the L parietal and down the L occipital. The other is a 'V' shaped mark starting on the R. parietal and crossing to the frontal, back over the R. parietal to the L parietal.
876	63 C1	Clavicle	Left	Unknown	Unknown	On the lateral inferior surface.

Table 4.13: Cut-marks present on the human skeletal elements originally buried inside wall niches, where R = right and L = left.

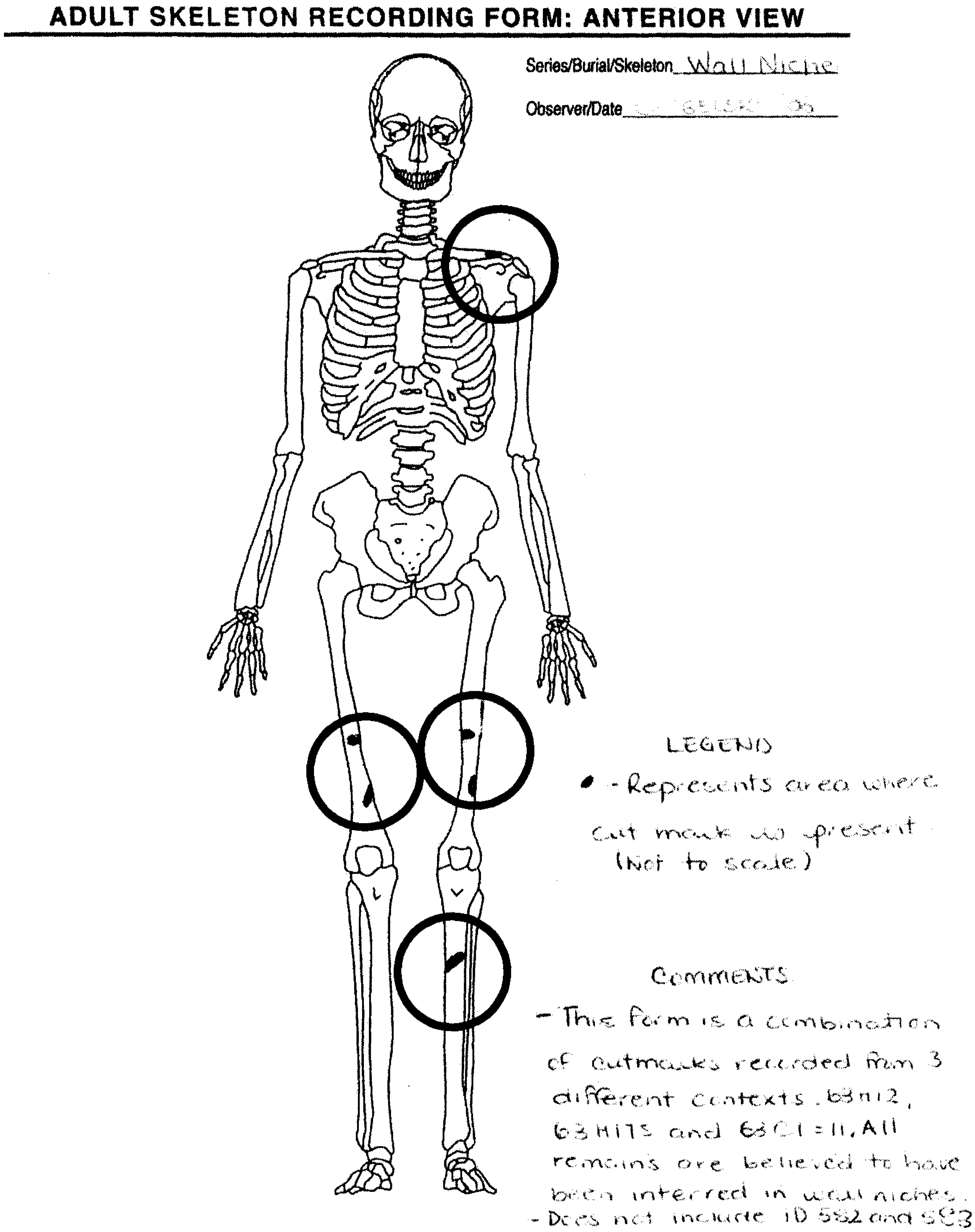

Figure 4.21: Location of cut marks on the skeletal remains recovered from 63H and 63C1 at Marcahuamachuco. Modified from Buikstra and Ubelaker (1994).

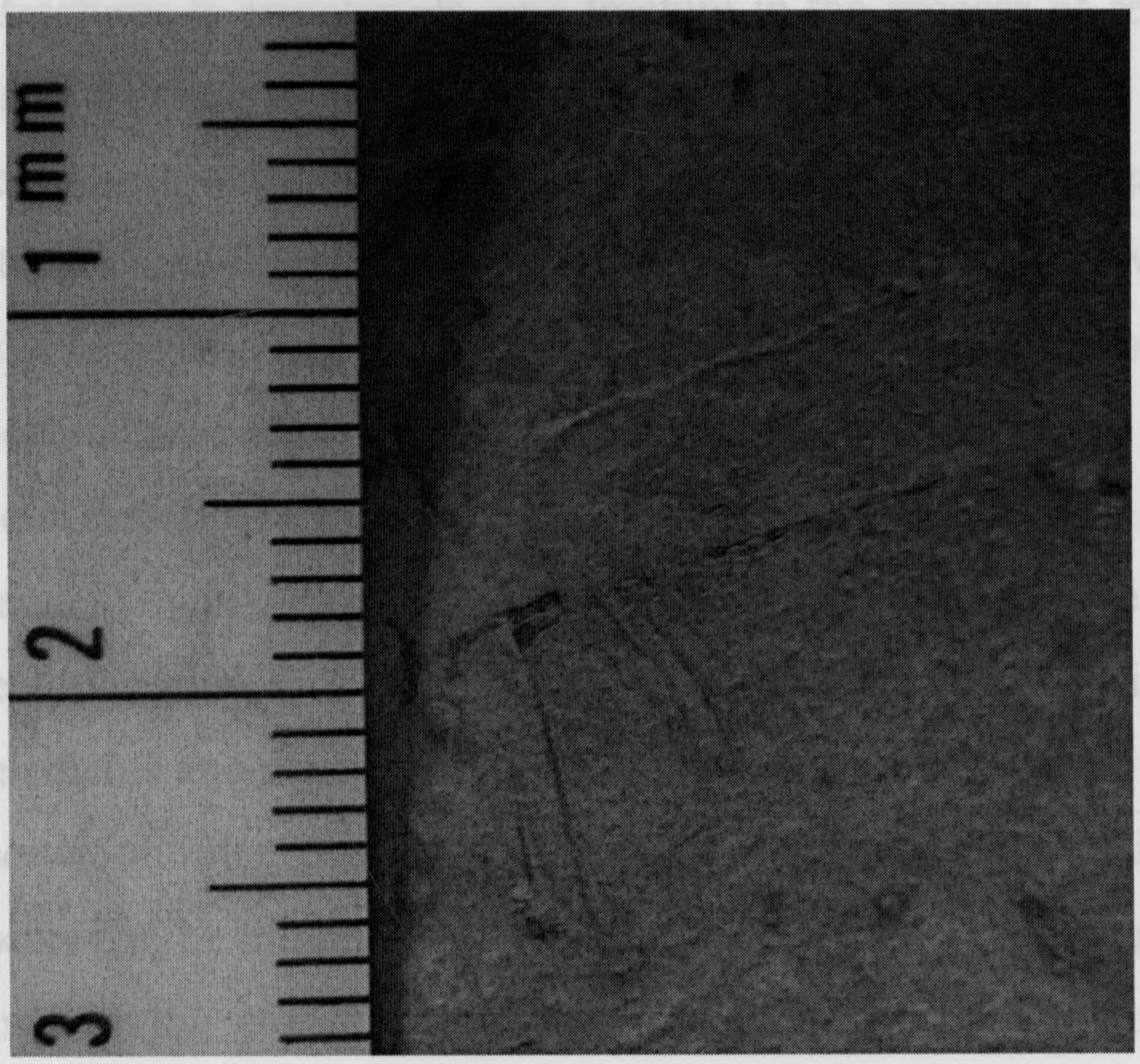

Figure 4.22: A young adult male, ID 582, with incised cut marks to the ectocranial surface of the calvarium

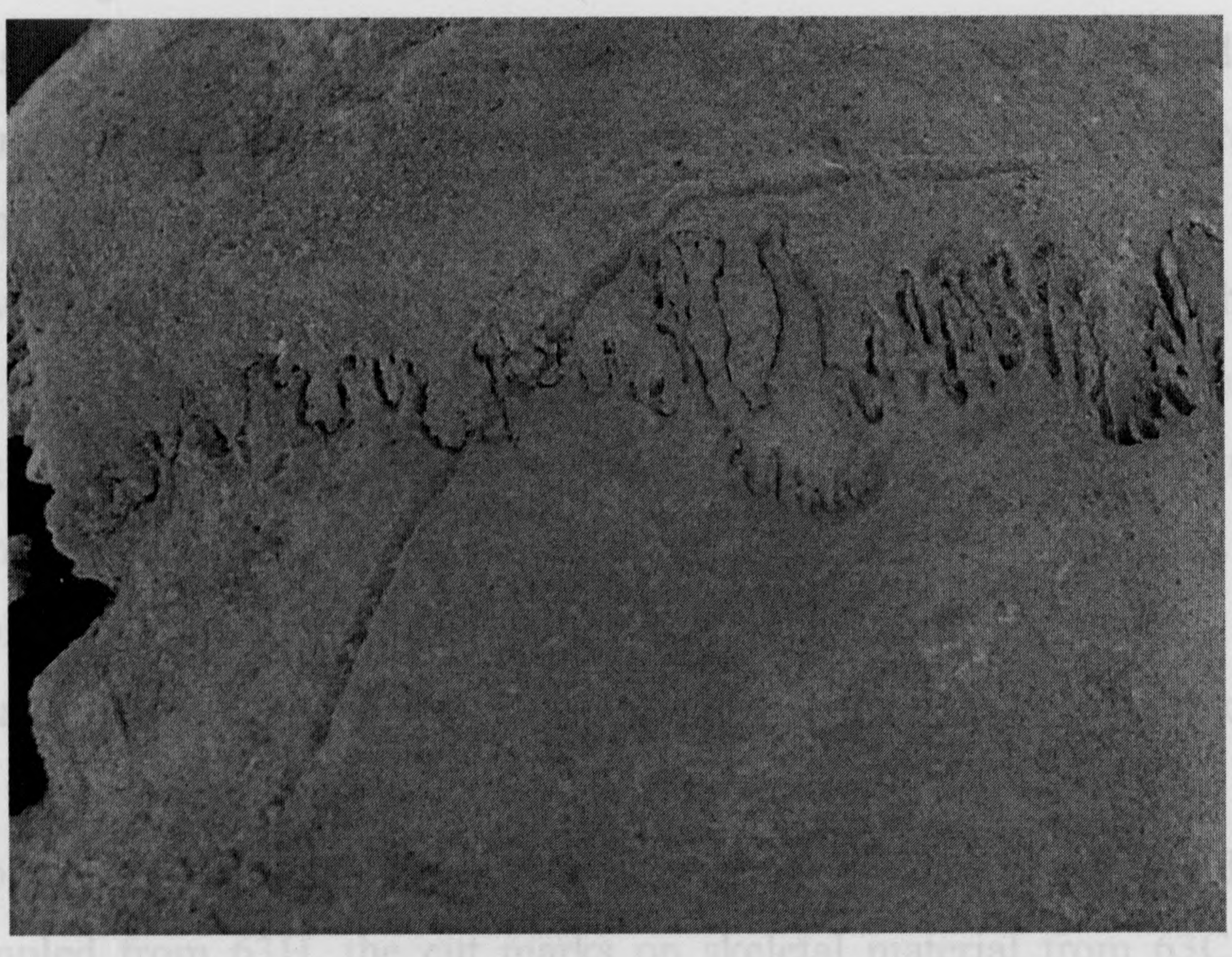

Figure 4.23: A young adult male with cut mark on the ectocranial surface of calvarium, ID 583

Most of the trauma found in the skeletal sample from 63C consisted of fractures, i.e. two healed fractures to metatarsals, one fracture in the process of remodelling in a tibia, and a healed fracture to the clavicle. Degenerative disease such as osteophytic activity and osteoarthritis were only observed on vertebrae. Dental disease was present, with numerous teeth exhibiting different severities of carious lesions. Several mandibles also had extensive tooth loss and bone resorption, with a few instances of active lesions in the alveolar bone (abscesses).

The skeletal material recovered from both 63H and 63C exhibited a wide range of taphonomic changes. Non-cultural taphonomic processes included extensive water damage, fragmentation, and root etching. All of these are consistent with having been exposed to the elements and the freeze/thaw cycle for many years. There were also some differential preservation rates, especially noticeable in material recovered from 63C, i.e. some bones appeared to be minimally affected by the elements. There was also evidence of recent rodent activity, classified by the parallel grooves and lighter non-stained exposed cortical bone.

The skeletal material recovered from 63H and 63C also exhibited several taphonomic changes consistent with human modification. Two bones recovered from 63C were also blackened and charred, consistent with having been exposed to a flame. However, due to the extreme fragmentation, there is a possibility that the fragments are not of human origin.

A few bones identified as human, had cut marks that were much lighter than the surrounding bone, which appeared consistent with trowel trauma. Around the midshaft of several long bones recovered from 63H were round, wide, 'u-shaped' grooves. The grooves do not appear consistent with conventional tools or implements that would have been available in the middle horizon, yet the kerf floor and the surrounding bone are all stained the same colour. Thus, it appears that the grooves were created around the time of death, while the bone was still plastic.

In contrast to the wide, round kerf floor of the incised marks found on skeletal material sampled from 63H, the cut marks on skeletal material from 63C seem more precise and 'v' shaped. The 'v-shaped' kerf floor on an incision on the frontal bone of a calvarium appears consistent with a sharp implement. Cut marks were also observed on a clavicle and calvarium, though the mark on the second calvarium is much more imprecise and meanders over the sutures of the skull.

4.2 The Castillo

This section (4.2) contains all the results from the analysis of the skeletal material that was originally interred underneath the Castillo at Marcahuamachuco. Analyses that were completed include MNI estimation, both metric and morphological sex assessment, age estimation, stature determination, non-metric trait analysis, pathological and health analysis, and analysis of non-cultural and cultural taphonomic processes.

4.2.1 Determination of Biological Sex

The following section discusses both the morphological and metric results of sex determination for the adult skeletal remains recovered from 63 Q3. It should be noted that these results possibly only represent a sample of the entire skeleton since the excavation pit was not expanded due to the extreme depth below datum, i.e. eight metres (Topic and Topic 1988b).

1. Morphological Determination of Sex

Morphological sex determinations are typically based on the characteristics of the skull and/or the os coxae. In the case of the skeletal material from 63Q3, no skull fragments were located and the pelvic bones were too fragmentary to provide any diagnostic sex indicators (see Table 4.14). From the 63Q3 adult skeletal remains, only the left humerus was able to provide a morphological sex determination (see Table 4.15). Examining for Rogers' (1999) distal humeral morphological characteristics, the humerus is consistent with female morphology.

	Cranial Morphology	**Frontal Morphology**	**Mastoid Process**	**Mandible Morphology**	**Os Coxa Morphology**	**Humerus Morphology**
Female	0	0	0	0	0	1
Male	0	0	0	0	0	0

Table 4.14: Morphological sex determinations for 63Q3.

2. Metric Determination of Sex

Metric sex determinations were included in the analysis since information on sex is pertinent to understanding the skeletal remains recovered from under the Castillo. The methods of metric sex determination were used for the ulna, femur and tibia, with no regard to laterality (Richman *et al.* 1979). Since each element was treated as a separate and distinct unit, the total number of determinations of sex does not accurately reflect the MNI. Metric analysis provided eight[17] sex determinations for 63Q3.

From the human skeletal material recovered from underneath the Castillo, one ulna was complete enough to input into the Safont *et al.* (2000) metric equations (see Table 4.16). The result was consistent with a female individual. Two metric methods, outlined by Safont *et al.* (2000) and Black III (1978) used the midshaft circumference of the femur (see Table 4.17). These methods provided an additional two sex assessments. As the right and left femur had similar size, robusticity, midshaft circumferences, they both yielded male sex determinations.

The discriminant functions of Trancho *et al.* (1997) used various measurements of the femur to estimate sex. The measurements provided an additional two sex assessments on the same femora used for Black III (1978) and Safont *et al.* (2000) metric methods (see Table 4.18). The sex determination resulted in a male designation, which concurred with the findings of the Black III (1978) and Safont *et al.* (2000) formulae.

Based on the discriminant functions created by Safont *et al.* (2000), the first measurement of the tibia used was the circumference at the nutrient foramen. ID 538 produced a male sex determination (see Table 4.19). In contrast, ID 538 produced a female sex assessment when the González-Reimers *et al.* (2000) metric equation was employed (see Table 4.20).

[17] The total number of sex determinations from metric methods reflects the number of individual bones utilized in the method. If a bone was used in more than one metric method, it was included only once.

ID	Location #	Bone	Side	Trochlear Constriction	Trochlear Symmetry	Olecranon Fossa Shape	Olecranon Fossa Depth	Angle of the Medial Epicondyle	Sex Determination
537	63 Q 3	Humerus	Left	Female	Female	Female	Female	Male	Female

Table 4.15: Sex determination based on the morphological characteristics of the humerus as outlined in Rogers (1999), for the adult skeletal elements recovered from underneath the Castillo.

ID	Location #	Bone	Side	Minimum Circumference (mm)	Discriminant Function Analysis	Sex Determination
565	63 Q 3	Ulna	Right	35	0.295	Female

Table 4.16: Discriminant function analysis of ulna recovered from underneath the Castillo based on Safont *et al.* (2000). Individuals with a score on a discriminant function greater than 0.415 are classified as males; those with a score less than 0.415 are classified as females; those with a score equal to 0.415 are unclassified.

ID	Location #	Bone	Side	Midshaft Circum. (mm)	Discrim. Function Analysis (Black 1978)	Sex Determination (Sectioning Point = 0.0)	Discrim. Function Analysis (Safont *et al.* 2000)	Sex Determination (Sectioning Point = 0.182)
504	63 Q 3	Femur	Left	87	6	Male	0.763	Male
567	63 Q 3	Femur	Right	88	7	Male	0.952	Male

Table 4.17: Discriminant function analysis femora recovered from underneath the Castillo based on Black III (1978) and Safont *et al.* (2000). Individuals with a score on a discriminant function greater than 0.0/0.182 are classified as males; those with a score less than 0.0/ 0.182 are classified as females; those with a score equal to 0.0/0.182 are unclassified.

ID	Location #	Bone	Side	Bi-condylar Length (mm)	Max Head Diameter (mm)	Sagittal Sub-trochanteric Diameter (mm)	Transverse Sub-trochanteric Diameter (mm)	Discrim. Function Analysis	Sex Determination
504	63 Q 3	Femur	Left		46.65	26.62	37.58	1.487	Male
567	63 Q 3	Femur	Right	76.00	45.94	25.35	32.55	0.608	Male

Table 4.18: Discriminant function analysis of femora recovered from underneath the Castillo based on Trancho *et al.* (1997). Individuals with a score on a discriminant function greater than 0.0 are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

ID	Location #	Bone	Side	Circumference at the NF (mm)	Discrim. Function Analysis	Sex Determination
538	63 Q 3	Tibia	Right	89	0.556	Male

Table 4.19: Discriminant function analysis of the tibia recovered from underneath the Castillo based on Safont *et al.* (2000).
Individuals with a score on a discriminant function greater than 0.252 are classified as males; those with a score less than 0.252 are classified as females; those with a score equal to 0.252 are unclassified.

ID	Location #	Bone	Side	Transverse Diameter at NF (mm)	Discrim. Function Analysis	Sex Determination
538	63 Q 3	Tibia	Right	19.68	-5.857	Female

Table 4.20: Discriminant function analysis of the tibia recovered from underneath the Castillo based on González-Reimers *et al.* (2000).
Individuals with a score on a discriminant function greater than 0.0 are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

3. Determination of Biological Sex Summary

Of the adult skeletal elements present in the assemblage from underneath the Castillo, two skeletal elements were identified as female, two were assessed as belonging to a male, and a tibia had both a female and male result from two different discriminant function formulae. Morphologically, the distal humerus is consistent with a female individual. It is the belief of the author and the archaeologists in charge of the excavation (Topic and Topic, personal communication) that only one person is represented by the skeletal elements; thus, the different morphological and metric sex determinations are conflicting.

As seen in the mini pilot project testing the applicability of metric methods of analysis on the determination of sex for two ancient Peruvian populations, i.e. San Jose to Moro and Pacatnamu, it is obvious that the accuracy and precision levels fluctuated drastically. Some methods appeared more reliable than others, but not one method accurately or precisely determined the biological sex of the individual one hundred percent of the time. Since there does not appear to be any overlap of skeletal elements, and all bones appear to be of approximately the same size and robusticity, the author is confident that the MNI remains at only one individual. Given the context, the morphological female determination and a couple of female determinations from metric methods of sex assessment, the author is of the opinion that the adult skeletal remains recovered from under the Castillo represent a young robust female.

4.2.2 Age Estimation

The following section discusses the results of the age analysis of the human skeletal remains recovered from underneath the Castillo at Marcahuamachuco. Similar to other analyses, each bone was treated a discrete unit of analysis. Therefore, the total number of age estimates does not accurately reflect the MNI of the sample. Only four age categories were represented by the skeletal elements (see Table 4.21). Based on size and morphology, fifteen of the skeletal elements were determined to belong to a fetus. To provide a more exact age, the length of the humerus and the length of two clavicles was taken and compared to known development lengths during gestation (Scheuer and Black 2000). The clavicles and the humerus produced the same age range of 36 to 38 weeks in utero, which is close to full term.

The remaining three age categories represented by the skeletal material recovered from 63Q3 were the juvenile/young adult, young adult and adult categories. All of the adult age determinations were based on the degree of epiphyseal fusion, size, robusticity and overall morphology of the bone. Of the 61 adult human bones analyzed, 59 were placed in the 'adult' category as the skeletal elements could not provide more diagnostic clues to aid in narrowing the age range.

Age Range	Female	Male	Unknown
Fetal	0	0	15
Juvenile (0 – 19 yrs)	0	0	0
Juvenile/Young Adult	0	0	1
Young Adult (20 – 30 yrs)	0	0	1
Middle Adult (30 – 40 yrs)	0	0	0
Old Adult (40+ yrs)	0	0	0
Adult	2	3	54

Table 4.21: Age estimation breakdown by skeletal elements recovered from 63Q3. Each record in the database was given an entry; thus, the information in the table does not accurately assess the demographic breakdown

The two juvenile/young adult and young adult age assessments were based on the pubic symphyseal face. The right pubic symphysis had characteristics consistent with female phases one and two of the Suchey-Brooks methodology, providing an age range of 15 to 23 years of age. The left pubic symphyseal characteristics fit more closely with the features outlined in stage three, providing an age range of 22 to 43 years of age. Although the age ranges overlap, the large error margins (Brooks and Suchey 1990) and difference in phases of development of the pubic symphysis can explain the discrepancy. However, looking at the skeleton overall, it appears the bones belonged to a young adult female.

4.2.3 MNI Results and Analysis

The MNI was determined to be two. The determination of the MNI for the skeletal remains excavated from beneath the Castillo structure at Marcahuamachuco was the simplest assessment of all three of the different burial contexts. A detailed inventory of the skeletal remains indicated that there is no overlap in the either the adult or fetal skeletal elements recovered (see Appendices F and G).

The age, stature and robusticity of the adult skeletal remains are all consistent with a single individual. All the bones appeared to belong to a female, with the pubic symphyseal age resembling that of a young adult. The results of the stature estimates, based on a complete femur and a partial tibia, differed by less than 0.5 cm when using the Del Angel and Cisneros (2004) male formula (see section 4.2.4), and less than 3.5 cm when utilizing the female formula[18].

The fetal bones do not appear to contain any skeletal overlap. The sizes of the bones are all consistent with a fetus of 36 to 38 week gestation. The sex is unknown, since there are no viable methods of sex determination for sub-adult or fetal remains save for DNA. The fetal remains all appear to be of similar robusticity. However, there is a slight size discrepancy between the right and left clavicles (see Figure 4.24). There is a 3.5mm difference in overall length, as well as a slight difference in overall curvature. The discrepancy can be explained as the result of taphonomic processes and post-mortem damage to the medial portion of the bone. The difference in curvature could also be due to normal human variation within the body. For these reasons, the fetal bones are believed to belong to the same individual.

[18] The similarity of the estimates is even more impressive since the length of the tibia was estimated using a formula created by Wright and Vásquez (2003)

4.2.4 Stature

The adult skeletal remains from 63Q3 provided a complete right femur and a right tibia shaft eligible for stature estimation. The female stature estimate was determined using the appropriate del Angel and Cisneros (2004) stature equation (see Table 4.26). The femur produced a female stature estimate of 155.6 cm. The tibia produced a female stature estimate of 153.6 cm. The femur and tibia provided very similar stature estimations.

Figure 4.24: Two fetal clavicles, ID 489 and 490, with the right outlined and superimposed upon the left. The picture illustrates the differences in curvature and length.

ID #	Location #	Femoral Max Length (cm)	Tibia Length (cm)	Stature Estimation Female[19] (cm)
567	63Q3	41.85		155.6
538♣	63Q3		33.95♀	153.6

Table 4.22: Table depicting the stature estimates for the adult individual buried underneath the Castillo.

The two stature estimates are consistent with mean stature estimates (refer to Table 5.1) for females from El Brujo and Sicán Capital populations, 159cm and 155cm respectively (Farnum 2002[20]). However, comparable to the highland site of Machu Picchu, which has a mean female stature estimate of 148.3cm, the young adult female buried under the Castillo would be considered tall and robust (Verano 2003a).

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[19] The calculation was made using the female (♀) maximum long bone length where applicable.

♣ The total length of this bone has been estimated using Wright and Vasquez's (2003) regression formulae

[20] Neither Farnum's (2002) nor Verano's (2003a) stature estimates utilize the adjusted Genoves formulae (del Angels and Cisneros 2004); thus, their stature estimates and/or ranges are slightly overestimated.

4.2.5 Health and Pathology

For the 63Q3 context, the fetal and adult skeletal remains display no evidence of health deficiencies or pathologies. With the absence of some of the skeletal remains, especially the skull, a complete pathological inspection is not possible. Overall, the bones appear healthy and robust.

4.2.6 Taphonomy

The following section discusses both the non-cultural and cultural taphonomic changes that the bones in the skeletal sample of 63Q3 underwent.

1. Non-cultural Taphonomy

Unlike the skeletal remains recovered from 63H, 63C1 or the Cerro Amaru mausoleum, climate and environment did not have a large impact on the bones. Figure 4.25, demonstrates the excellent preservation of the skeletal remains recovered from underneath the Castillo. This may be due to a combination of the depth, approximately 8.0 m below the floor of the Castillo, and the clay that encased the remains (Topic and Topic 1988b). Also, the skeletal elements were not exposed to episodes of looting and/or weathering from the elements.

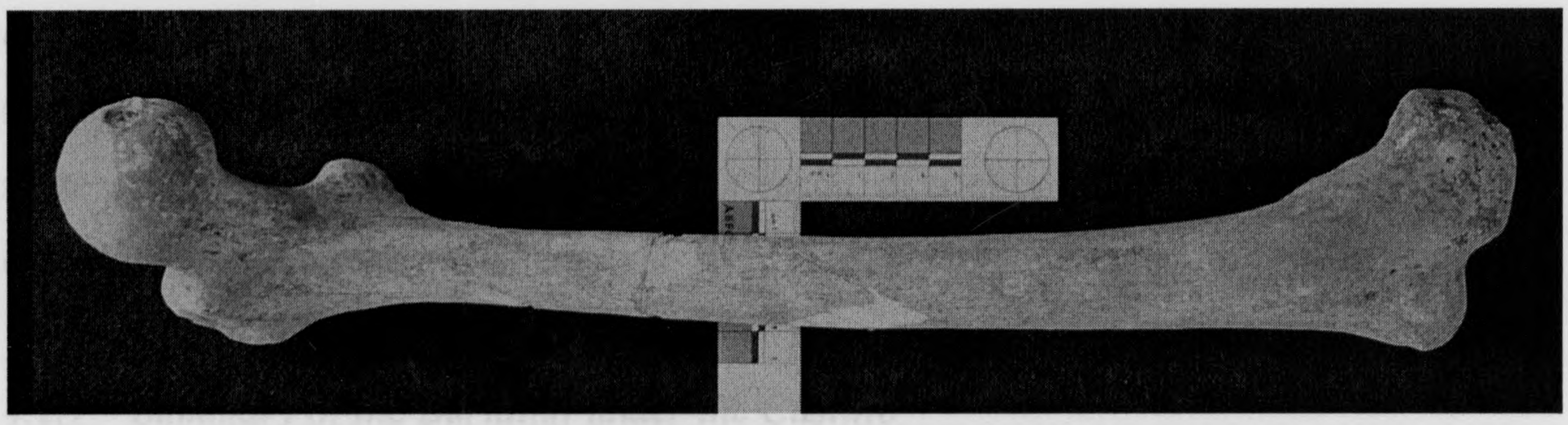

Figure 4.25: Well preserved right femur, ID567 (medial aspect).

2. Cultural Taphonomy

The most prevalent form of taphonomic change to the skeletal remains recovered from 63Q3 was intentional human modification (see Figure 4.26 and Table 4.23). Incised marks were found on the axis, calcaneus and several long bones, notably at the joints. As illustrated in Figures 4.27 and 4.28, there are small parallel incisions on the medial side of the right superior articular facet, and on the inferior side of the left lamina of the axis vertebra. An incised mark was also located on the calcaneus, in a groove between the two articular surfaces and on a left ulna, medial to the trochlear notch.

The right and left heads of the humeri each displayed shaved surfaces (see Figures 4.29 and 4.30). The marks were located on the side of the head, possibly where the humeri would have articulated with the scapulae. The marks were stained the same colour as the surrounding bone, indicating that the marks were not created recently. The circular and oblong shaved areas are 16.4 by 19.1 mm and 12.2 by 22.7 mm respectively. Both of the traumas have linear parallel striae that run across the entire surface, which were likely caused by the tool that created the large shaved surfaces. The left femur recovered from 63Q3 displayed several different types of incisions. First, the greater trochanter has a smooth shaved surface, similar to the one witnessed on both the right and left humeri. The second set of cut marks observed were rounded chiselled linear marks located on the anterior and posterior aspects of the head (see Figure 4.31 and 4.32). The marks are stained the same colour as the surrounding bone, indicating that the marks are not recent.

The distal end of the femur also displayed evidence of intentional human modification. The posterior medial condyle has been sheared off, with the cut mark continuing along the same plane into the lateral condyle. The cut only penetrates 22.8 mm of the total 40.3 mm width of the lateral condyle (see Figure 4.32). The surface of the cut is stained the same colour as the surrounding bone surfaces. When the condyle is reattached to the rest of the femur (see Figure 4.33), the extent of the trauma becomes more apparent. The mark was likely the result of a chopping motion, where the tool completely severed the medal condyle, and cut into lateral condyle.

4.2.7 Summary of the Burial(s) under the Castillo

The skeletal remains recovered from underneath the Castillo at Marcahuamachuco, provided an MNI of two. The skeletal material represented one fetus at 36 to 38 week gestation and a young healthy robust adult woman of average height comparable to coastal sites and tall compared to the highland site of Machu Picchu (stature estimate were 153.6cm and 155.6cm). Although there was a discrepancy between metric sex determinations, i.e. both male and female results were generated, the remains are most

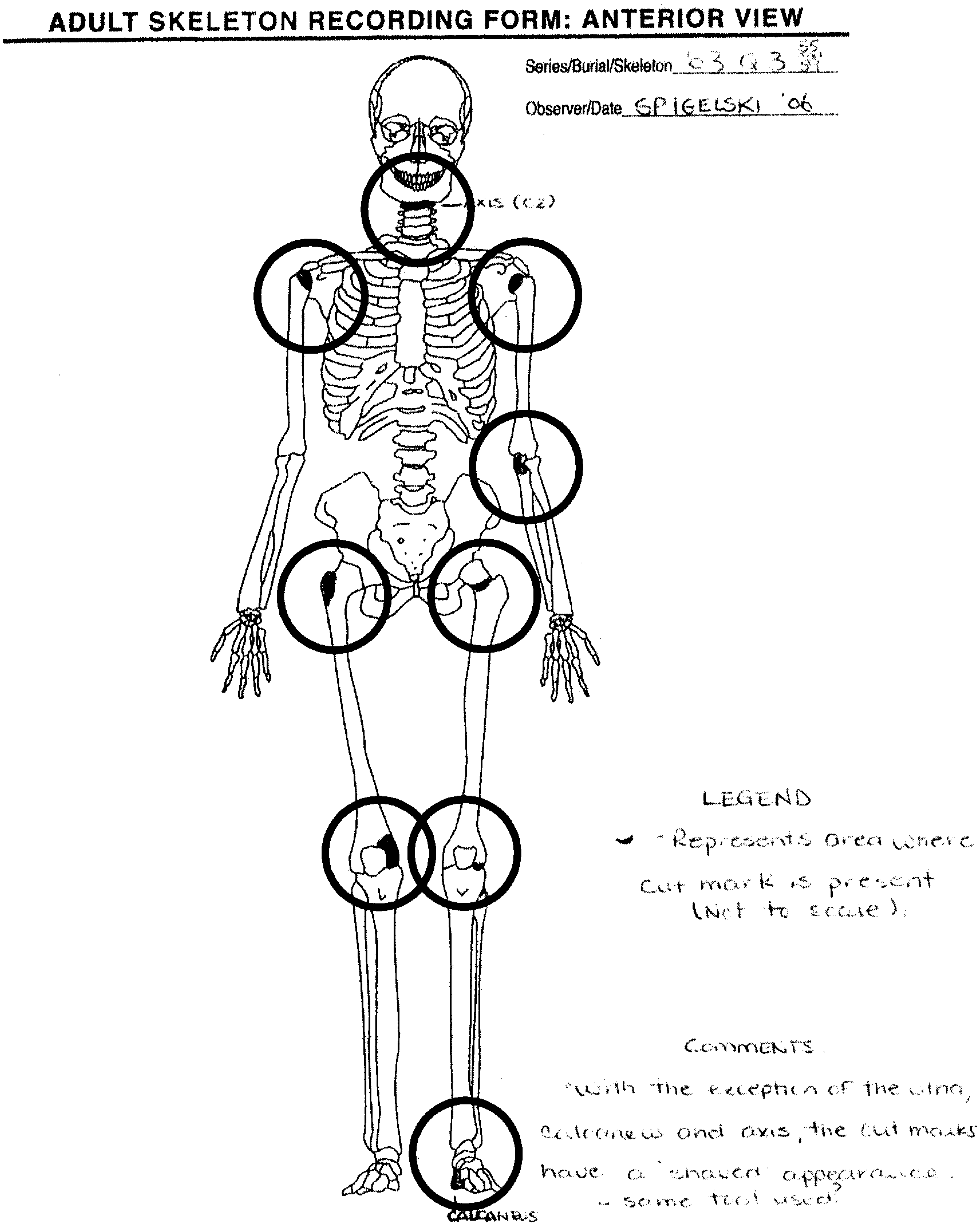

Figure 4.26: Location of cut marks on the skeletal remains recovered from 63 Q3 at Marcahuamachuco. Modified from Buikstra and Ubelaker (1994).

ID	Location #	Bone	Side	Sex Determin.	Age Est.	Location of Cut Marks
504	63 Q3	Femur	Left	Male	Adult	On the head of the femur (closer to the neck), one with red pigment? Has a shaved appearance on the lateral condyle.
509	63 Q3	Axis (C2)	N/A	Unknown	Adult	On the medial side of the R superior articular facet and on the inferior side of the L lamina.
514	63 Q3	Calcaneus	Left	Unknown	Adult	In the groove between the two articulations on the superior surface.
532	63 Q3	Humerus	Unknown	Unknown	Adult	Evidence of scraping on one side - almost a circular patch - 16.4 by 19.1mm
533	63 Q3	Humerus	Unknown	Unknown	Adult	Large oblong scrape on the surface - with some trabeculae showing - 12.2 by 22.7mm
566	63 Q3	Ulna	Left	Unknown	Adult	On the medial side, to the left of the trochlear notch.
567	63 Q3	Femur	Right	Male	Adult	Posterior medial condyle is 'shaved' off, with marks continuing along the same plane into the lateral condyle (only 22.8mm of the total 40.3mm width). It appears the greater trochanter may have also been removed at the same time, leaving a smooth surface.

Table 4.23: Table listing/describing all cut-marks present on human skeletal elements recovered from the adult burial under the Castillo.

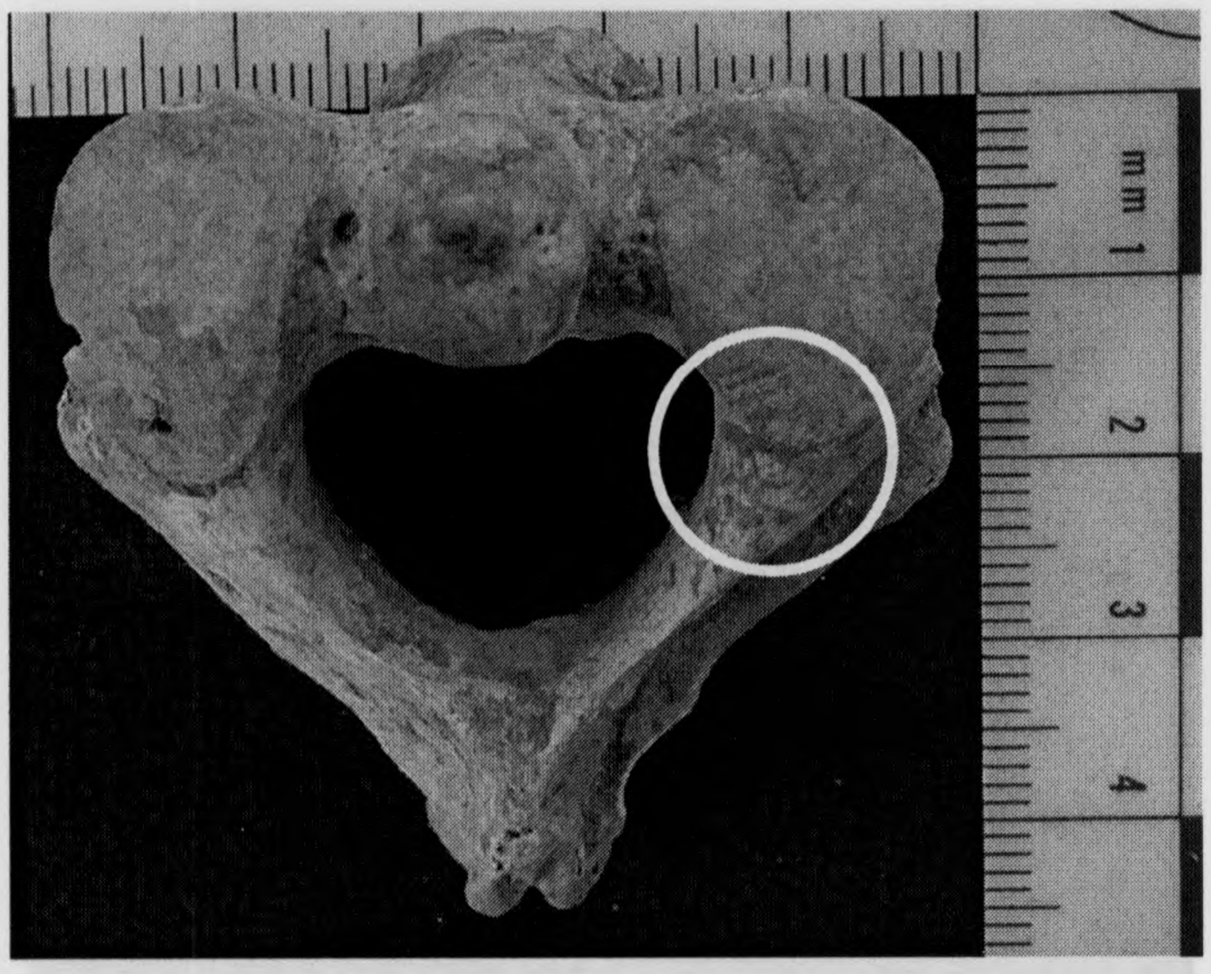

Figure 4.27: Incised cut marks (circled) on the right superior articular facet of axis, ID 509

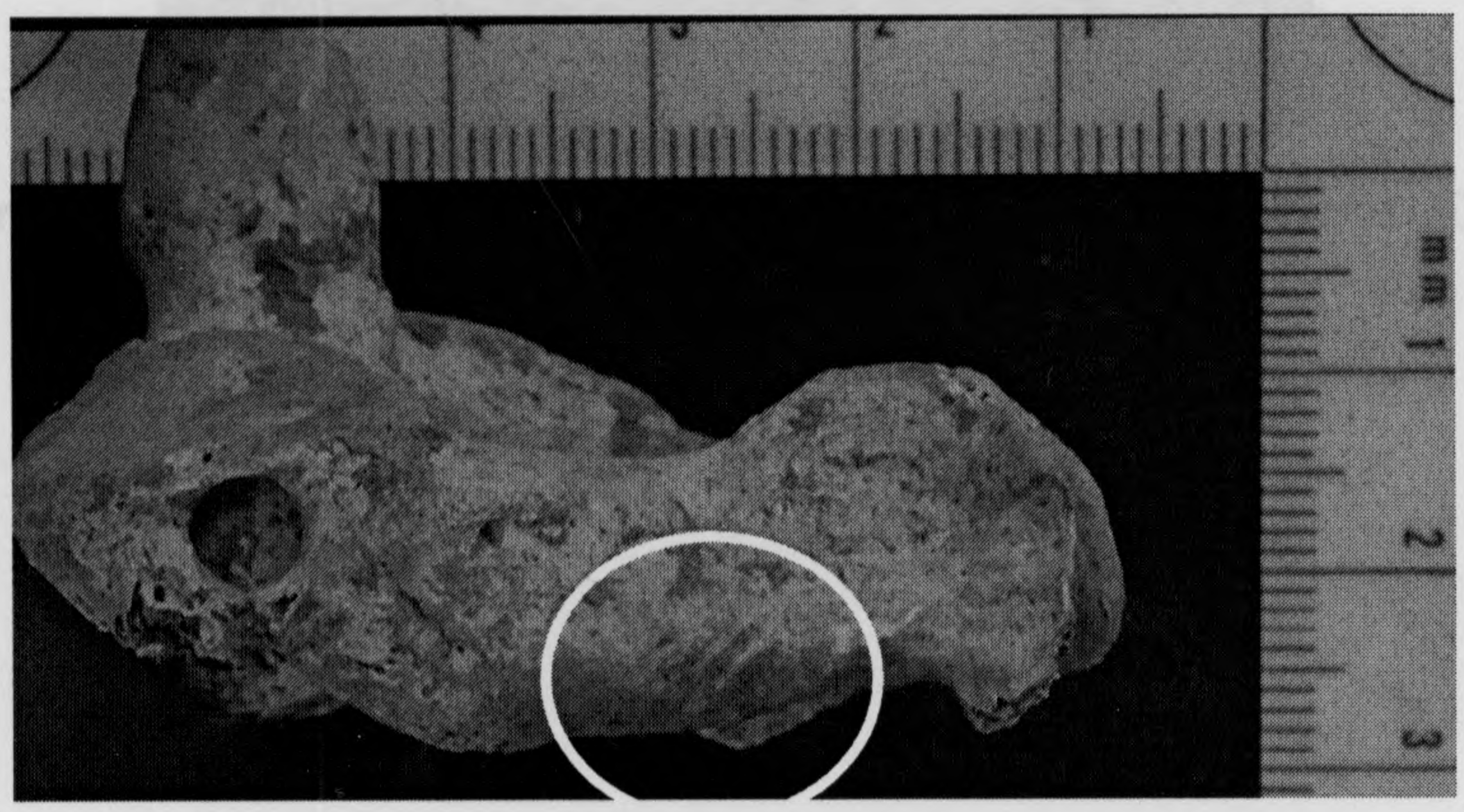

Figure 4.28: Linear cut marks (circled) on left lamina axis, ID 509

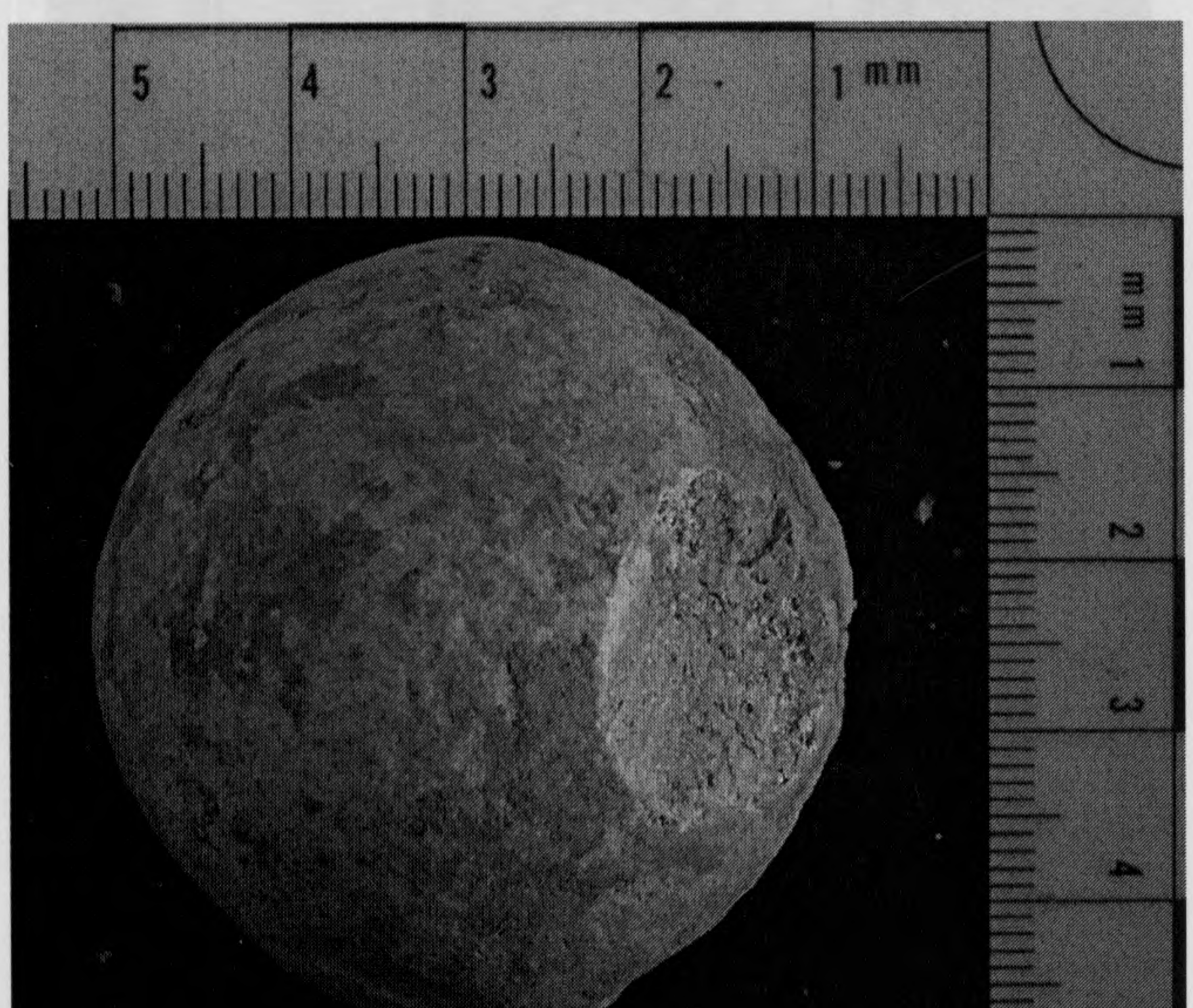

Figure 4.29: A 'shaved/scraped' ovoid on the head of the right humerus, ID 532

Figure 4.30: A 'shaved/scraped' ovoid on the head of the left humerus, ID 533.

Figure 4.31: Anterior aspect of the left femoral head ID 504 depicting large incised marks

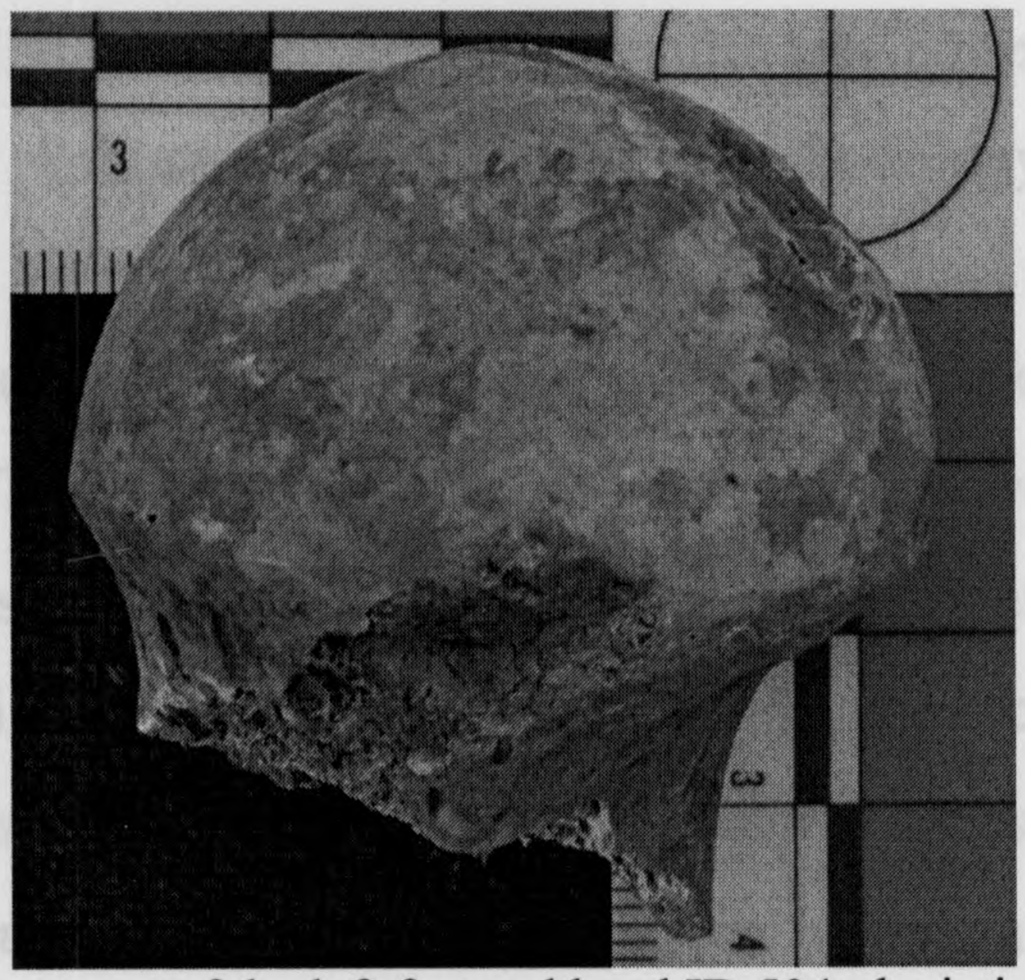

Figure 4.32: Anterior aspect of the left femoral head ID 504, depicting large incised marks

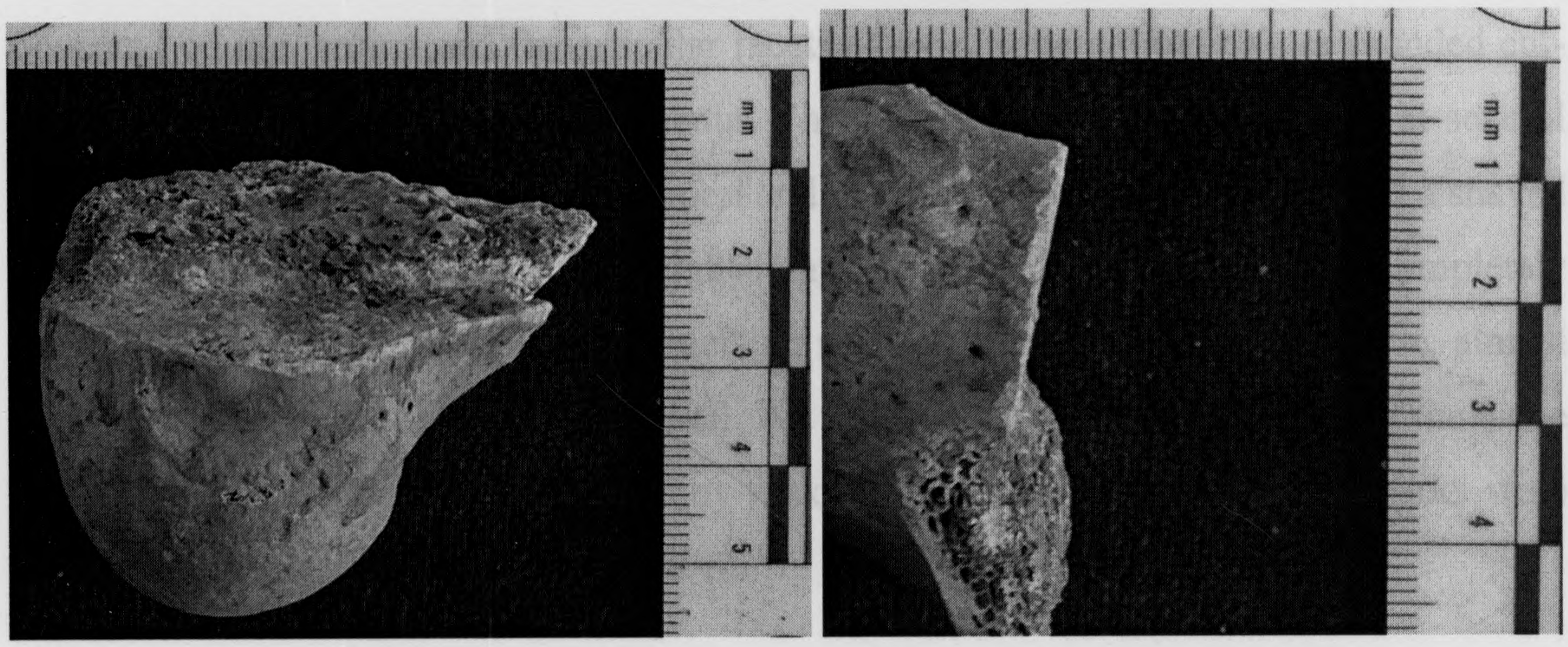

Figure 4.33: A penetrating cut into the lateral condyle of a right femur, ID 567

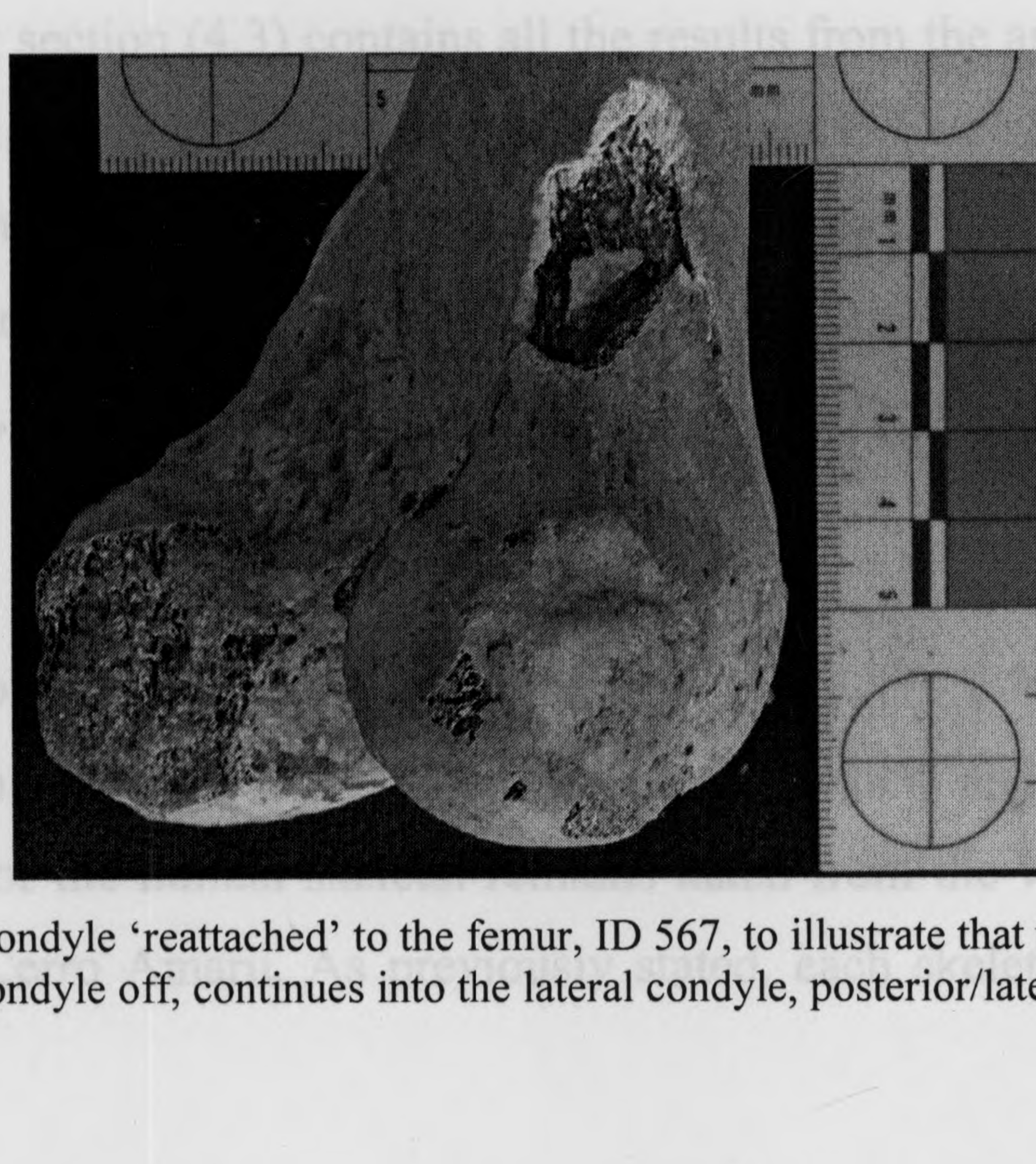

Figure 4.34: Lateral condyle 'reattached' to the femur, ID 567, to illustrate that the cut that 'shaved' the medial condyle off, continues into the lateral condyle, posterior/lateral aspect.

likely from a single individual. The differing results can be explained through normal human variation and/or problems with the metric methodology as it relates to ancient Peruvian populations.

Non-cultural taphonomic processes did not overtly affect the skeletal material recovered from 63Q3. The bones are extremely well-preserved with no evidence of exposure to the elements. The exceptional preservation is directly linked to the extreme depth below datum of eight metres at which the bones were recovered, and the fact that the bones were not exposed to climatic changes or looters' disrespect.

In contrast, cultural taphonomic processes were abundant throughout the skeletal adult remains. Smaller, more precise parallel incisions with a 'v-shaped' kerf floor were observed on the lamina and the articular facets of axis. Several larger more rounded cut-marks appeared on the neck of the femur. There were also cut-marks located at several major joints. Both the heads of the humeri and the heads of the femora exhibited a shaved appearance at the joint surface. The right femur also had the medial condyle completely shaved off, with a clean and precise incision right down into the lateral condyle, almost severing that portion of the bone as well. All incisions/cut-marks were stained the same colour as the surrounding bone; thereby making it appear as if all the cut marks were created at or around the time of death.

4.3 Mausoleum

The following section (4.3) contains all the results from the analysis of the skeletal material that was originally interred inside the mausoleum at Cerro Amaru. Analyses that were completed including MNI estimation, both metric and morphological sex assessment, age estimation, stature determination, non-metric trait analysis, pathological and health analysis, and analysis of environmental and human modified taphonomic processes.

4.3.1 Determination of Biological Sex

The following section provides both the morphological and metric results of the assessment of sex for the human skeletal remains taken from the within the confines of the mausoleum at Cerro Amaru. As previously stated, each skeletal element had to be assessed independently of any other bone due to extensive commingling and fragmentation; therefore, the numbers do not accurately reflect the demographics of the site or the overall MNI. Since the entire structure was excavated, all morphological sex determinations have been grouped under a single category.

1. Morphological Determination of Sex

Due to the lack of preservation and excessive amount of commingling, in most instances sex was determined using a single morphological characteristic, i.e. the morphology of the mastoid process, mandible and the humerus. Eighteen morphological sex determinations were made on 18 separate skeletal elements (see Table 4.24).

	Cranial Morph.	Frontal Morph.	Mastoid Process	Mandible Morph.	Os Coxa Morph.	Humerus Morph.	Consensus MNI[21]
Female	0	0	7	1	0	2	5
Male	0	0	4	4	0	0	3

Table 4.24: Morphological sex determinations for the mausoleum.

The first bone examined morphologically was the temporal, which provided 11 elemental sex determinations. The seven temporals determined to be female included three right and four left temporals. Four male assessments were made on a single right and three left temporals. It is possible that one or more of the right/left male/female temporals were from the same individual(s).

Four mandibular pieces (one left, two right and one complete mandible), were determined to belong to male individuals, while only one mandible was consistent with a female individual. A right and left humerus were each assessed as female as they both displayed four out of five of the morphological characteristics consistent with females as outlined by Rogers (1999), (see Table 4.25).

2. Metric Determination of Sex

Due to extensive water damage and fragmentation, metric methods of sex determinations were only applied to the femur and the tibia. An additional seven[22] sex

[21] Although only a minimum of three males and five females could be identified in the assemblage, the total MNI was fourteen.

determinations were provided for the mausoleum. Three different metric analyses were conducted on the viable femora recovered from inside the mausoleum. The first two methods, outlined by Safont *et al.* (2000) and Black III (1978), both used the midshaft circumference (see Table 4.26). With the exception of one right femur (ID 450) that was determined to be male, all femora were assessed as female using the Safont *et al.* (2000) equations. In contrast, using Black III (1978) methodology, all femora were determined to belong to females. The discrepancy occurred on ID 450, which could be directly linked to intraobserver error, since the determination of the location of midshaft is difficult in cases of fragmentation and poor preservation[23].

It is possible that ID 286 and 287 are from the same individual, since both are similar in size and robusticity. The other left femur (ID 452) has a circumference measurement that is similar to ID 288 and ID 450. However, it is also possible that the left femur ID 452 belongs to the individual who contributed the right ID 450 since, ID 450 and 452 are from a similar location within the walls of the mausoleum.

Two sex determinations were made using the Trancho *et al.* (1997) functions based on femoral measurements (see Table 4.27). ID 288, a right femur corroborated the female result found in the analysis completed using both the Safont *et al.* (2000) and the Black III (1978) methods. ID 157 provided an additional female sex determination. The skeletal measurements from the two femora recovered from within the mausoleum are similar, making it possible that they were from the same individual.

Based on the discriminant functions created by Safont *et al.* (2000) and González-Reimers *et al.* (2000), ID 449 was determined to be female (see Table 4.28 and 4.29 respectively).

3. Determination of Biological Sex Summary

When analyzing the morphological and metric sex determinations in conjunction with one another, it is evident that there are at least three males and five females represented in the skeletal material. Of the bones available for determining sex, only the

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[22] The total number of sex determinations from metric methods reflects the number of individual bones utilized in the method. If a bone was used in more than one metric method, it was included only once.
[23] Both of the femora assessed from 64 A7 consisted only of the shaft.

ID	Location #	Bone	Side	Trochlear Constriction	Trochlear Symmetry	Olecranon Fossa Shape	Olecranon Fossa Depth	Angle of the Medial Epicondyle	Sex Determination
471	64A7	Humerus	Left	Female	Female	Female	Female	Male	Female
472	64A7	Humerus	Right	Female	Female	Female	Female	Male	Female

Table 4.25: Sex determination based on the morphological characteristics of the humerus as outlined in Rogers (1999), for the skeletal elements recovered from the mausoleum.

ID	Location #	Bone	Side	Midshaft Circum. (mm)	Discrim. Function Analysis (Black 1978)	Sex Determination (Sectioning Point = 0.0)	Discrim. Function Analysis (Safont *et al.* 2000)	Sex Determination (Sectioning Point = 0.182)
286	64A2	Femur	Right	75	-6	Female	-1.505	Female
287	64A2	Femur	Left	75	-6	Female	-1.505	Female
288	64A2	Femur	Right	78	-3	Female	-0.938	Female
450	64A7	Femur	Right	82	1	Male	-0.182	Female
452	64A7	Femur	Left	80	-1	Female	-0.560	Female

Table 4.26: Discriminant function analysis of femora recovered from the mausoleum based on Black III (1978) and Safont *et al.* (2000). Individuals with a score on a discriminant function greater than 0.0/0.182 are classified as males; those with a score less than 0.0/ 0.182 are classified as females; those with a score equal to 0.0/0.182 are unclassified.

ID	Location #	Bone	Side	Max Head Diameter (mm)	Sagittal Sub-trochanteric Diameter (mm)	Transverse Sub-trochanteric Diameter (mm)	Discrim. Function Analysis	Sex Determination
157	64A2	Femur	Left	27.53	21.95	28.80	-7.463	Female
288	64A2	Femur	Right		21.73	27.63	-1.938	Female

Table 4.27: Discriminant function analysis of femora recovered from the mausoleum based on Trancho *et al.* (1997). Individuals with a score on a discriminant function greater than 0.0 are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

ID	Location #	Bone	Side	Circumference at the NF (mm)	Discriminant Function Analysis	Sex Determination
449	64 A 7	Tibia	Right	80	-1.190	Female

Table 4.28: Discriminant function analysis of the tibia recovered from the mausoleum based on Safont *et al.* (2000).
Individuals with a score on a discriminant function greater than 0.252 are classified as males; those with a score less than 0.252 are classified as females; those with a score equal to 0.252 are unclassified.

ID	Location #	Bone	Side	Max Prox Epiphyseal Breadth (mm)	Transverse Diameter at NF (mm)	Discrim. Function Analysis	Sex Determination
449	64 A 7	Tibia	Right	61.15	21.3	-7.769	Female

Table 4.29: Discriminant function analysis of the tibia recovered from the mausoleum based on González-Reimers *et al.* (2000).
Individuals with a score on a discriminant function greater than 0.0 are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

temporal, mandible, humerus, femur and tibia were complete and well preserved enough to enable a viable sex assessment.

4.3.2 Age Estimation

The following section provides the results of age estimation for the human skeletal remains taken from the Mausoleum contexts 64A2, 64A6 and 64A7. To better understand the demographics of the structural complex that housed all the remains sampled from the mausoleum, all age determinations have been grouped into a single category.

With the exception of fetal remains, all age categories are represented to some degree (see Table 4.30). From the skeletal collection recovered from the mausoleum, six bones were identified as juvenile based on their size and amount of development, i.e. a couple of femoral shafts, a right humeral shaft, a portion of a right mandible, and a piece of a temporal bone. Two young adult assessments were based on the dentition and eruption sequences found in the maxillae, while a third was based on the closure of the latero-anterior cranial sutures. It is possible that one of the maxillae belonged to the same individual as the calvarium.

Based on occlusal wear patterns, a mandible was classified as belonging to a middle adult male and a maxilla was identified as belonging to a middle adult of indeterminate sex. Based on the size of the bones, it is possible that the mandible and maxilla belonged to the same individual.

Age Range	Female	Male	Unknown
Fetal	0	0	0
Juvenile (0 – 19 yrs)	0	0	6
Juvenile/Young Adult	0	0	0
Young Adult (20 – 30 yrs)	0	0	3
Middle Adult (30 – 40 yrs)	0	1	1
Old Adult (40+ yrs)	1	0	4
Adult	2	2	4

Table 4.30: Age estimation breakdown by skeletal elements recovered from within the mausoleum. Each record in the database was given an entry; thus, the information in the table does not accurately assess the demographic breakdown

A calvarium and several mandible pieces were determined to belong to at least two older adult individuals. One of the mandibles was complete enough to provide a female sex assessment, while the other three lacked defining sexual characteristics. For the mandibles, age was determined through the attrition rates of the remaining dentition and the number of teeth that were lost antemortem and alveoli that were completely resorbed. The age of the calvarium was determined by the amount of cranial suture closure. Most of the endocranial and ectocranial sutures displayed complete fusion.

The final broad range of age distribution was located in the adult age category, which provided eight age determinations. Four adult bones were complete enough to provide two male assessments and two female determinations. The remaining four adult age estimations were based on bones of indeterminate sex. Due to fragmentation and taphonomic processes, a more precise age determination was not feasible.

4.3.3 MNI Results and Analysis

The following results and analysis of the data obtained from within the mausoleum has been broken down into one main category and two different subcategories based on their provenience within the Mausoleum (see Figure. 2.10 for an overview of the structure of the mausoleum). The Mausoleum was unique in this analysis, since it was excavated and analyzed in its entirety. Therefore, to better understand the demographics of the Mausoleum, the information obtained from the skeletal elements has been treated as a complete unit. Although the skeletal contents of Cist 1, i.e. Vessel D and Vessel T, have been included in the overall MNI, they have also been included as separate entries, to facilitate a better understanding of the only Cist that appeared to have been undisturbed and sealed since antiquity (Topic and Topic 1984).

1. Mausoleum, 64A2, 64A6 and 64A7

The MNI for the entire mausoleum was determined to be 14 (see Table 4.31). The assessment was based on the number of sided femora shafts (10 rights, 11 lefts and six unsided). Most of the femora shafts lacked identifying characteristics, as their cortical bone was destroyed by weathering. Therefore, the MNI was established by the smallest quantity of 'sided' femora shafts, when the unsided bones were combined with the sided femora shafts.

LOCATION	DESCRIPTION OF LOCATION	MNI (Based on Bone Overlap)	BONE(S)/TEETH USED FOR DETERMINATION
64A2, 64A6 and 64A7	Mausoleum	14	Femur
64A6	Vessel D, Cist 1	1	Teeth (no overlap)
64A6	Vessel T, Cist 1	3	First Molars (Modified by attrition on unidentified molar)

Table 4.31: MNI determination for the skeletal remains recovered within the mausoleum at Cerro Amaru.

Incorporating the sex and age distribution of the skeletal assemblage from the Mausoleum, it is apparent that there was no discrimination against age and/or sex. With the exception of fetal remains, there are skeletal elements belonging to individuals ranging in age from juvenile to old adult. There also appeared to be at least three males and five females represented in the skeletal assemblage.

In the skeletal remains recovered from inside the Mausoleum, there was at least one juvenile, represented by a couple of portions of femoral shaft, a piece of a temporal and a portion of a right mandible. There were two portions of right young adult maxillae of undetermined sex, and one mid adult male mandible/maxilla. There was also evidence of at least two older adult individuals, one apparent female and one of unknown sex, as evidenced by severe dental attrition and alveolar bone resorption in two mandibles.

Within the Mausoleum, skeletal elements were identified from both the appendicular and axial skeleton. Long bones appeared to be the most prevalent skeletal element found within the assemblage. Thus, it can be inferred that although the mausoleum housed primary interments, secondary deposits of long bones may have been more customary.

2. 64A6 – Cist 1, Vessel D

The MNI for Vessel D is one (see Table 4.24). The only skeletal elements recovered from Vessel D were tooth crowns, which display little to no occlusal wear. There were no duplicates found in the teeth, i.e. from the same side or position (mandibular/maxillary).

3. 64A6 – Cist 1, Vessel T

The MNI for Vessel T is three (see Table 4.24). With the exclusion of one fragment of the petrous portion of a temporal bone found in Vessel T, the only skeletal elements recovered from within Cist 1 were teeth. With the exception of two partial and one complete root, all the teeth recovered were enamel crowns. Several of the crowns had a polished wear pattern where the root used to attach to the crown (Figure 4.35). The author is unsure of whether the pattern on the base of the crown was intentional.

The most identifiable and numerous of the crowns were the first molars (M1). In total six M1s were recovered and analyzed. The determination was based on the presence of two sets of right and left maxillary M1s. All of the M1s displayed little to no visible occlusal wear. However, one unsided/unidentified molar displayed severe attrition. Therefore, at least two younger and one older individual(s) had to contribute to the tooth assemblage.

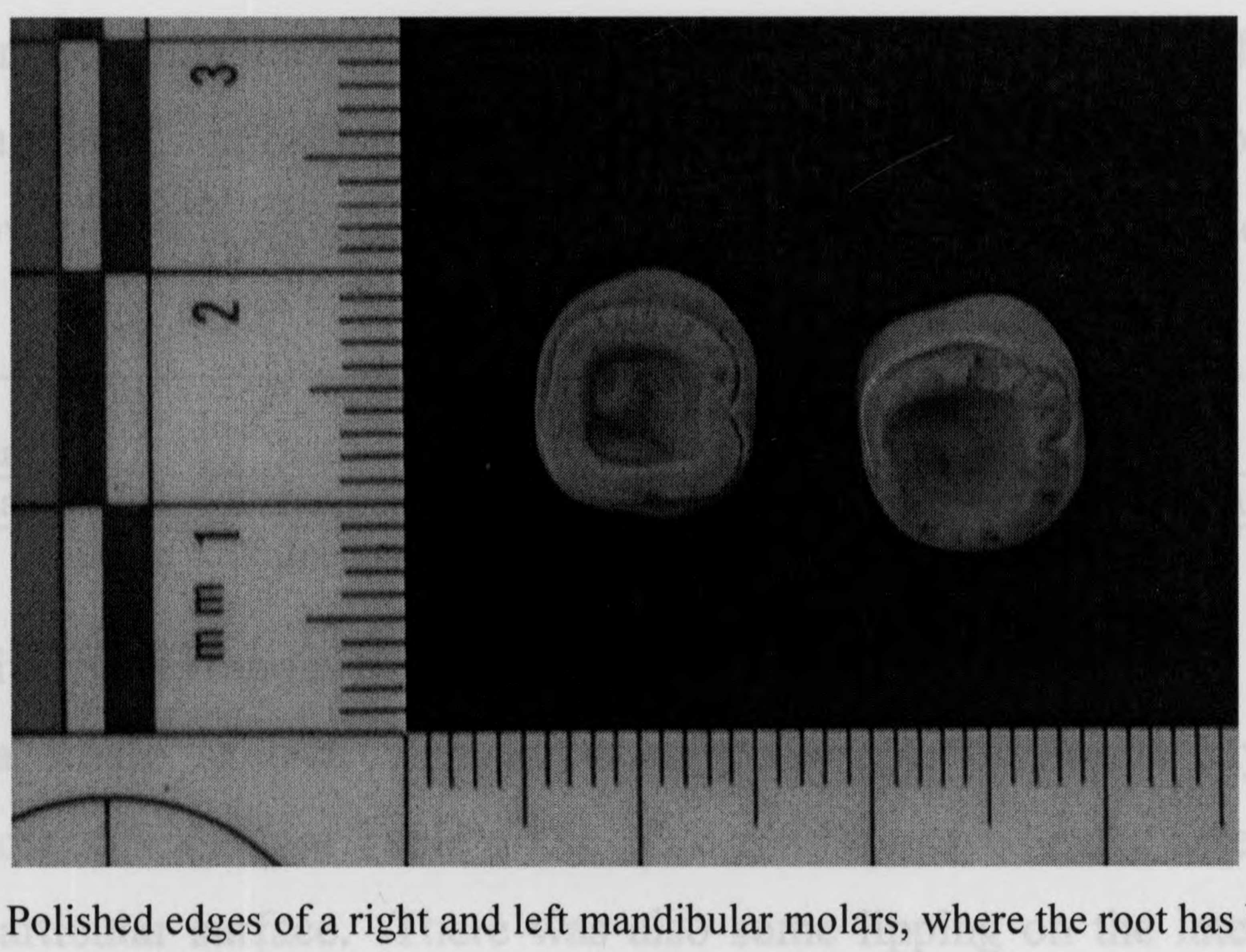


Figure 4.35: Polished edges of a right and left mandibular molars, where the root has been removed

4.3.4 Stature

Due to the extensive water damage and highly fragmented nature of the skeletal remains recovered from within the confines of the mausoleum, no long bones were complete enough to calculate a living stature. Therefore, no data are currently available about the height of the individuals interred in the mausoleum.

4.3.5 Health and Pathology

The following section describes the different palaeopathological specimens recorded in the sampling of the mausoleum at Cerro Amaru. This section has been broken down into several inclusive categories: trauma, degenerative joint disease, dental disease and skeletal stress indicators.

1. Trauma

The only incident of trauma observed in the skeletal collection recovered from within the mausoleum was a possible blunt force injury to an occipital bone, ID 208, of a young adult of unknown sex (see Table 4.32 and Figure 4.36). There are several radiating fractures emanating away from the point of impact. One of the radiating fractures moves towards the top of the cranial vault and clearly dissipates at the lambdoidal suture. The trauma appears consistent with a star-shaped mace head (Nelson, personal communication). Trauma does not appear to be prevalent in the remains of those interred inside the mausoleum, i.e. only one out of the four calvaria recovered displayed any sign of trauma. However, it is apparent that some form of interpersonal violence did occur.

ID	Location	Bone	Side	Sex Determin.	Age Est.	Trauma
208	64A2 Main Room	Calvarium	n/a	Unknown	Young Adult	Blunt Force Trauma

Table 4.32: Incidents of trauma in mausoleum skeletal collection

2. Degenerative Joint Disease

Only a single skeletal element, a talus ID 224, displayed any evidence of degenerative joint disease (see Table 4.33). The talus displayed extra osseous growth on the calcaneal articular surface. There was also some lipping on the lateral side of the posterior calcaneal articular surface. These degenerative bone changes could have been the result of repetitive stress and/or natural bone degeneration related to aging.

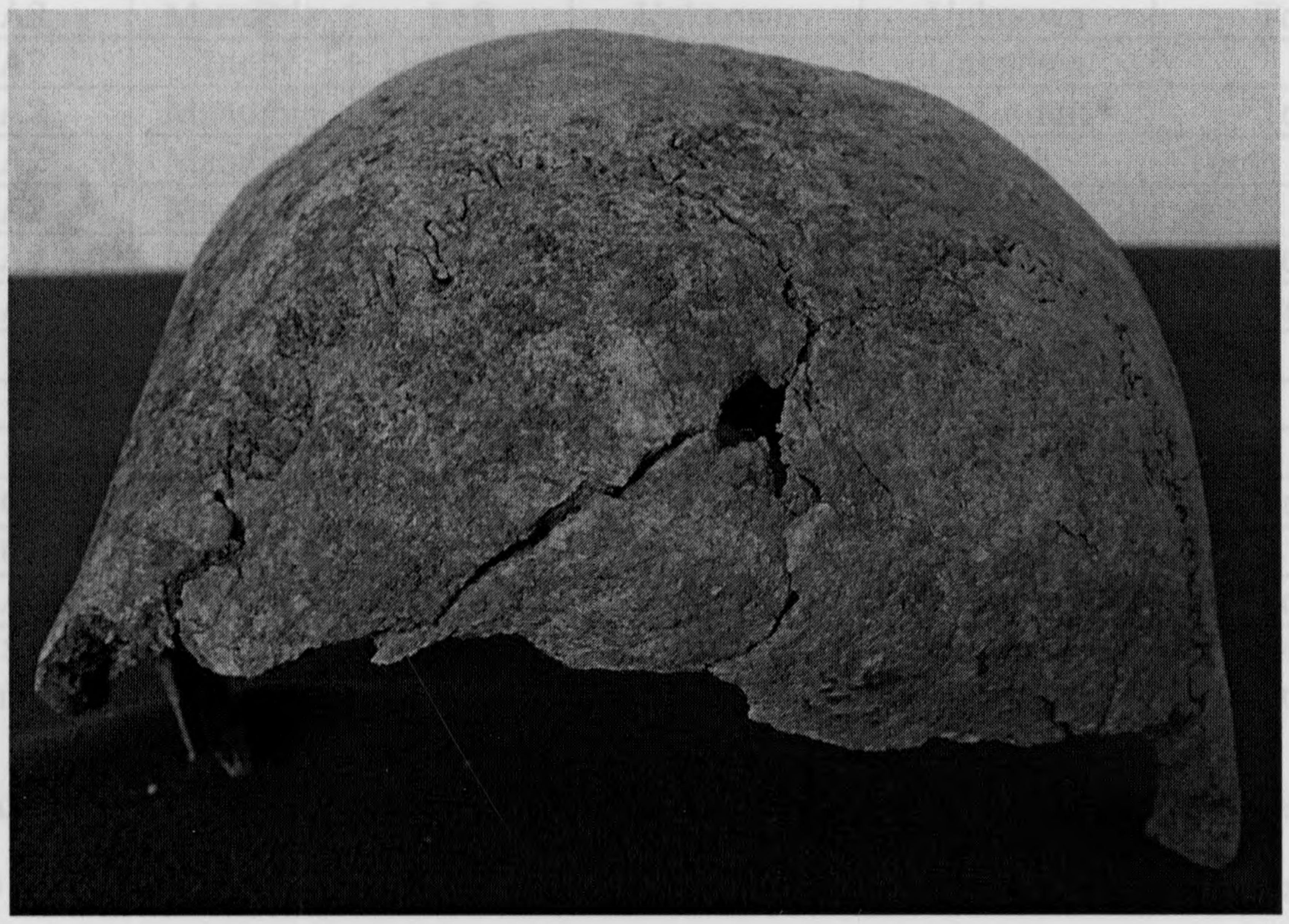


Figure 4.36: Calvarium displaying blunt force trauma image, ID 208. Note radiating fractures that spread from point of impact.

ID	Location	Bone	Side	Sex Determin.	Age Est.	Degenerative Joint Disease
224	64A2	Talus	Right	Unknown	Adult	Osteoarthritic Lipping and Osteophytic Activity

Table 4.33: Skeletal elements that exhibit degenerative joint disease in the mausoleum skeletal collection.

3. Dental Disease

Dental disease afflicted individuals interred inside the mausoleum, with dental caries and tooth loss being the most common ailments (see Table 4.34). Of all the teeth examined for this thesis, only a single incisor, ID 388, exhibited evidence of linear enamel hypoplasia (LEH). Most dental pathologies were limited to the molars or posterior portion of the mandible. ID 177 had the right second and third mandibular molar sockets fully resorbed. ID 180 had a left second mandibular molar socket resorbed. Both ID 260 and 262 had right third molar sockets fully resorbed. ID 263 had active alveolar remodelling of most the right tooth sockets (see Figure 4.37). ID 259 had the socket for a left second premolar completely resorbed. ID 488 was the only individual who exhibited complete antemortem tooth loss of all mandibular incisors, and yet retained the rest of the posterior dentition.

ID	Location	Bone	Side	Sex Determin.	Age Est.	Dental Disease
177	64A2	Mandible	Right	Male	Adult	Tooth Loss
178	64A2	Mandible	Right	Male	Middle Adult	Caries
180	64A2	Mandible	Left	Unknown	Unknown	Tooth Loss
257	64A2	Tooth	Unknown	Unknown	Unknown	Caries
259	64A2	Mandible	Left	Unknown	Old Adult	Tooth Loss
260	64A2	Mandible	Left	Male	Adult	Tooth Loss/Abscess
261	64A2	Mandible	Left	Female	Old Adult	Caries
262	64A2	Mandible	Right	Unknown	Old Adult	Tooth Loss
263	64A2	Mandible	Right	Unknown	Old Adult	Tooth Loss/Caries
311	64A6 Cist 1	M_2	Right	Unknown	Unknown	Caries
357	64A7 Cist 3	Molar	Unknown	Unknown	Adult	Caries
379	64A7 Cist 3	Canine	Unknown	Unknown	Adult	Caries
388	64A7Cist 3	Incisor	Unknown	Unknown	Adult	Enamel Hypoplasia
468	64A7Cist 4	Molar	Unknown	Unknown	Adult	Caries
488	64A7	Mandible	n/a	Male	Unknown	Tooth Loss

Table 4.34: Skeletal elements and teeth that exhibit dental disease in the mausoleum skeletal collection. Unless otherwise stated, the bones/teeth were recovered from within the main room of the mausoleum.

Carious lesions were expressed on the sides of molars ID 257, 357 and 468. ID 178 and ID 311 had occlusal caries on the right third mandibular molar and the left mandibular first molar, respectively. ID 261 had a buccal carious lesion on the right second mandibular molar and a distal caries on the right first mandibular molar. ID 263 also displayed a buccal caries on the right second mandibular molar. Some of the antemortem posterior tooth loss and buccal caries could have been directly associated to coca chewing. However, the more diagnostic characteristics of heavy coca use were not expressed, namely triangular root caries and severe root exposure (Indriati and Buikstra 2001).

Figure 4.37: Antemortem tooth loss, with alveolar bone in the process of remodelling, ID 263.

4. Skeletal Stress Indicators

With the exception of the single loose incisor, ID 388, which displayed evidence of childhood stress in the form of LEH, there was no evidence of skeletal stress on the bones recovered from inside the mausoleum. The lack of stress indicators could either mean that the population was extremely healthy, or that the information is simply not available due to the extensive water damage and fragmentation of the skeletal material.

4.3.6 Taphonomy

The following section discusses the taphonomic changes that the bones in the skeletal sample from within the mausoleum underwent. The taphonomic analysis includes both non-cultural and cultural processes. To better understand the context of mausoleum, the skeletal material recovered from the main room has been combined with the material located inside the three cists (see Table 4.35).

1. Non-Cultural Taphonomy

Environmental and climatic conditions greatly affected the skeletal material interred inside the walls of the mausoleum. All of the bones were stained a dark brown colour, consistent with soil staining. Water and weathering were the most influential factors, as they damaged the cortical bone of most of the skeletal material, erasing identifiable characteristics. These processes also aided in the fragmentation of the bones. The bones in most instances can be likened to pieces of bark, since they demonstrated the same roughness and coarseness on their surfaces.

Some of the skeletal elements also had evidence of rodent gnawing. These marks were distinguished from cultural taphonomic processes, by the characteristic parallel grooves (see Figure 4.38), caused by the rodent's front central incisors. The marks do not appear to be recent as they are stained the same colour as the surrounding cortical bone.

2. Cultural Taphonomy

The destruction and deterioration of the skeletal material was also aided through human intervention. Numerous bones in the collection from within the mausoleum displayed evidence of having been burnt in a fire, (see Figure 4.39). The exception was material recovered from Cist 1. Cist 1 was the only sealed cist found inside the mausoleum. Therefore, it is apparent that the mausoleum must have burned after the skeletal material was deposited inside Cist 1.

The skeletal remains were also subjected to crushing and fragmentation due to the weight of large rocks (Topic and Topic 1992). Topic and Topic (1992) attribute the preservation of the mausoleum to the fact that rocks cleared from an adjacent field for agricultural practices had been piled atop the structure. However, in preserving the structure, the rocks likely broke some of the surviving bones by the shear force of their weight on top of the interments.

Evidence of intentional human modification was also observed in the skeletal remains recovered from inside the mausoleum (see Figure 4.40). The marks are localized to the neck of the femur and the ankle joint. A talus, ID 224, had a large incised mark on the superior surface of the bone, running from the head to the lateral side of the trochlea (see Figure 4.41). An adult female left femur, ID 157, had a linear cut inferior to the lesser trochanter. A single long bone fragment, ID 171, had an incised trauma under the '64' recording number[24]. ID 160 had a perpendicular incised cut mark on the shaft of femur (see Figure 4.42). All incised marks, were stained the same colour as the surrounding bone. The non-differential soil staining indicates that the marks are not recent. Some lighter areas were apparent around the incised trauma on ID 160, although the kerf floor remained stained the same colour as the surrounding bone. The cortical surface surrounding the incised mark was extremely weathered and roughened. Therefore, the bone surrounding the trauma likely flaked away more recently, aided by the condition of the bone.

4.3.7 Summary

When looking at the Mausoleum as a complete unit, it is apparent that it contained a MNI of at least fourteen individuals. This assessment was based on the quantity of femora that was examined from the sites of 64A2, 64A6 and 64A7. With the exception of fetal remains, all age ranges appear to be represented, i.e. bones from individuals ranging in age from juvenile to adult.

[24] Of all the skeletal material observed, this long bone fragment was the only bone to have an identifying number recorded on the bone.

Figure 4.38: Long bone with linear grooves consistent with rodent gnawing, ID 162

Figure 4.39: One of the many burned skeletal elements found in the mausoleum, ID 488

ID	Location #	Bone	Side	Sex Determin.	Age Est.	Location of Trauma
152	64 A2	Fragment	Unknown	Unknown	Unknown	Cut marks present near the end of the fragment
157	64 A2	Femur	Left	Female	Adult	Linear cut inferior to the lesser trochanter.
160	64 A2	Femur	Right	Unknown	Unknown	Small cut mark on the anterior surface 9.25mm long (perpendicular to the shaft)
171	64 A2	Long Bone Frag.	Unknown	Unknown	Unknown	Under the '64' of the artefact recording number
172	64 A2	Phalange	Unknown	Unknown	Unknown	Cut marks at the proximal end
183	64 A2	Femur	Left	Unknown	Unknown	On the shaft.
224	64 A2	Talus	Right	Unknown	Old Adult 40+ yrs	Superior aspect - running from the top of the head to the lateral side of the trochlea.

Table 4.35: Table listing/describing all trauma present on the human skeletal elements recovered from the mausoleum.

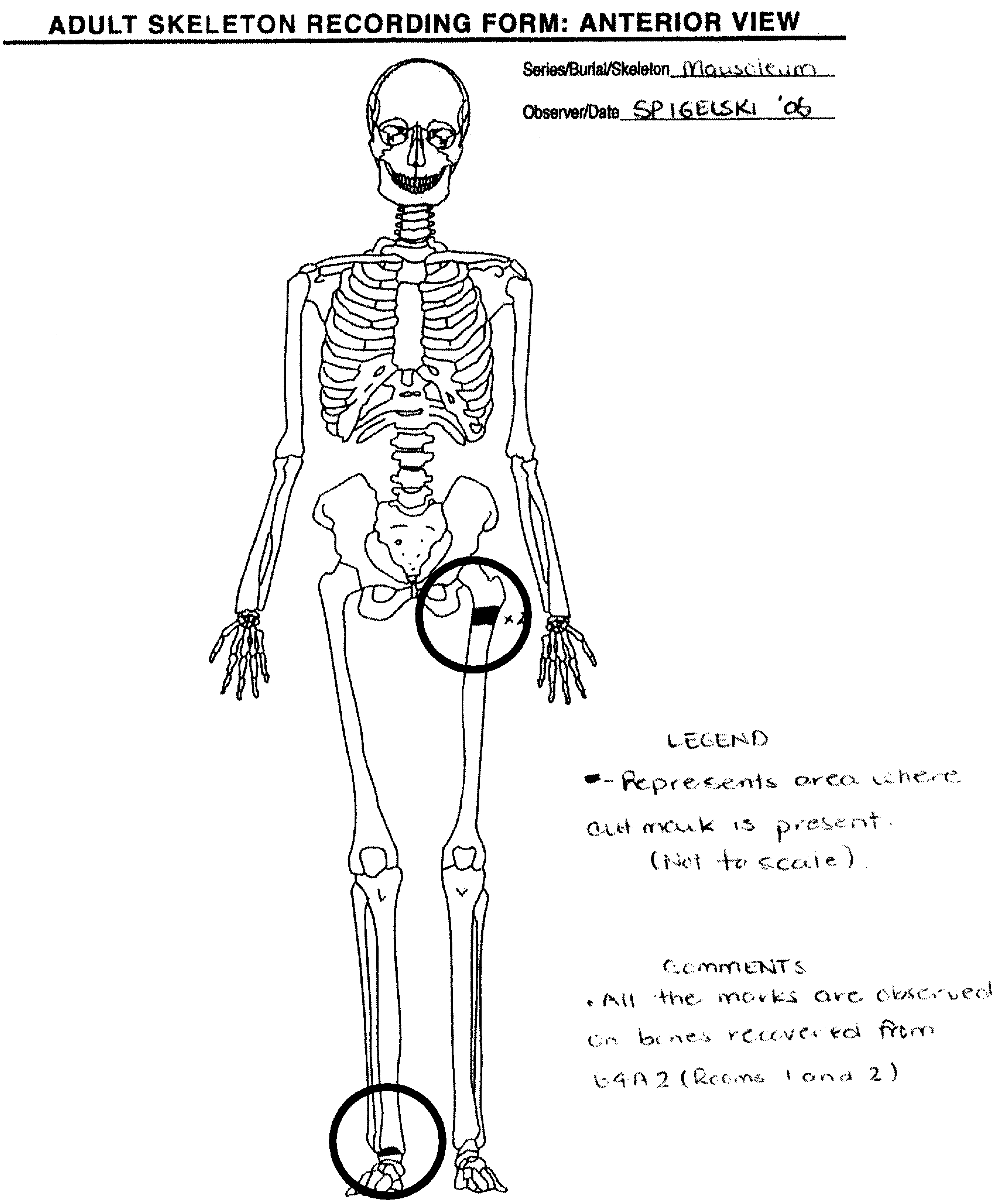


Figure 4.40: Location of cut marks on the skeletal remains recovered from inside the mausoleum at Cerro Amaru. Modified from Buikstra and Ubelaker (1994).

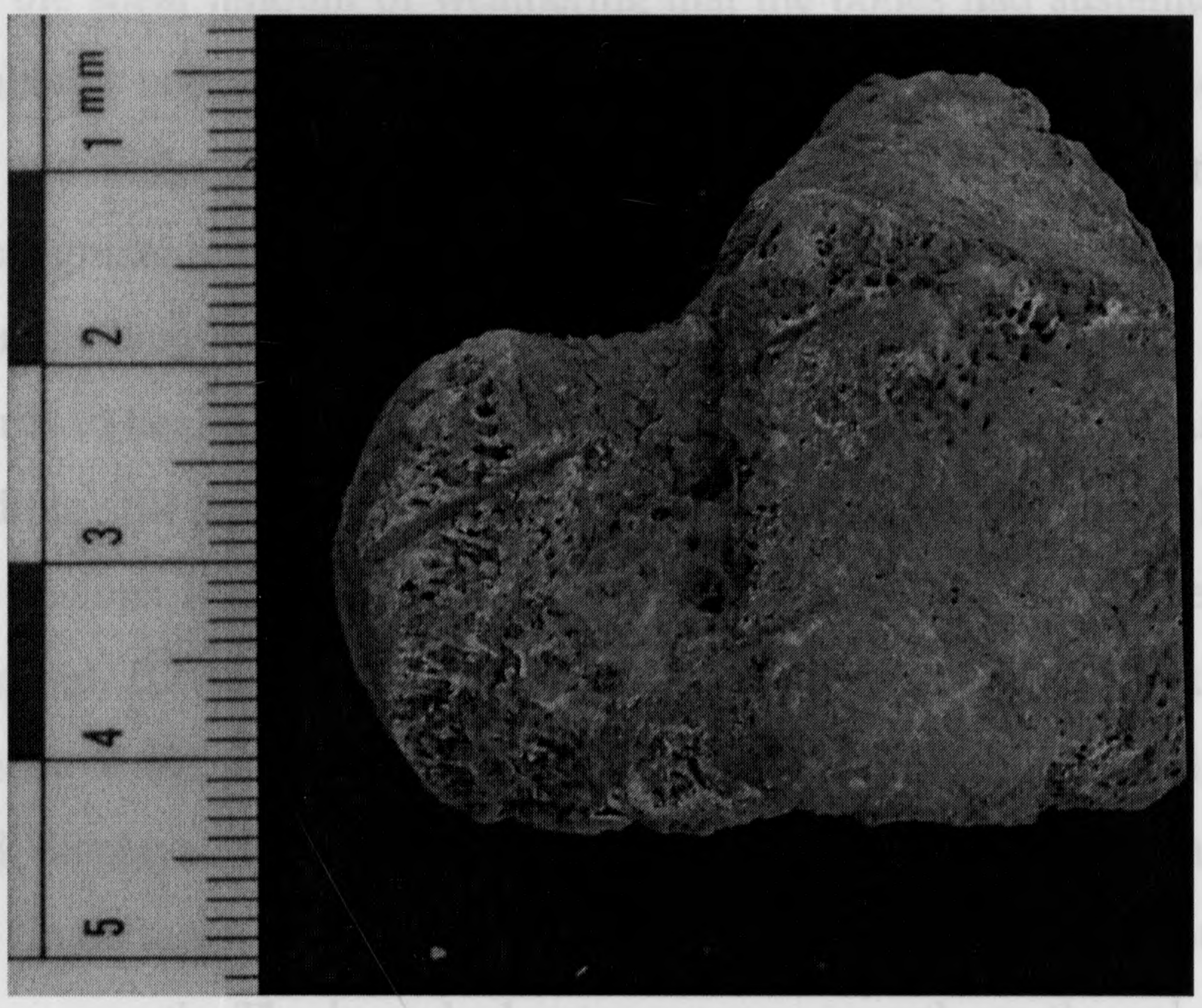


Figure 4.41: A right talus with incised linear cut marks on the superior surface, ID 224

Figure 4.42: A right femoral shaft with a cut mark into the surface, ID 160

In the assemblage, there are bones belonging to at least one juvenile, two young adults of unknown sex, one middle adult male, one old adult female, and one older adult of unknown sex. In total, there are bones exhibiting enough identifiable characteristics belonging to at least three recognizable male individuals, and five females.

Due to the shear amount of weathering that the bones had sustained, most of the skeletal assemblage consisted of fragmented 'bark-like' pieces of cortical bone. The fragmentation and distortion of identifiable characteristics ensured that no bones were complete or recognizable enough to complete an analysis on stature. Therefore, no data are available on the height of the individuals buried inside the Mausoleum.

In regards to health, tooth loss and carious lesions were the predominant ailments, with one mandible still displaying an active lesion or abscess in the alveolar bone. Most of the carious lesions had occurred on the mesial/distal portions of the enamel. One mandible stood out, ID 488, as the individual had lost all the anterior teeth antemortem, but retained most of the posterior dentition. Out of all the teeth analyzed, only a single incisor, ID 388, displayed LEH. No other bones showed any sign of skeletal stress.

Only a single talus, ID 224, had evidence of degeneration of the bone, in the form of extra osseous growth. The bone had extra osseous growth on the calcaneal articular surface and some lipping on the lateral side of the posterior calcaneal articular surface. The deterioration of the bone could have been the result of old age and/or a repetitive stress injury.

Out of the four calvaria that were complete enough to analyze, one showed evidence of blunt force trauma to the occipital bone of ID 208. The bones of the calvarium are consistent with a young adult of unknown sex. There are several visible radiating fractures that move away from the point of impact. The trauma appears consistent with a star-shaped mace, which would indicate some form of interpersonal violence.

As previously stressed, environmental and climatic conditions altered the bones significantly. All of the bones were stained a dark brown colour, which is consistent with the soil of the area. Water and weathering were the most detrimental factors. They damaged the cortical bone of most of the skeletal material, leaving most bones unrecognizable and devoid of identifiable characteristics. Several of the bones also demonstrated the classic signs of rodent gnawing, i.e. parallel incised grooves. The gnaw marks appeared to have occurred in antiquity as they are stained the same colour as the surrounding bone.

The bones were also altered through human intervention. The bones appeared to have been subjected to high degrees of heat and fire, as they are charred and blackened. Preparation of fields for agriculture crushed and fragmented bones, when large rocks were cleared from the surrounding fields and placed on top of the site of the mausoleum. So, although farmers preserved the structure, they hindered the preservation of the bones themselves.

A few of the bones recovered from inside the Mausoleum also displayed evidence of intentional human modification. The marks appear localized to the neck of the femur and the ankle joint. A talus, ID 224, had a large incised mark on the superior surface of the bone, while several femora had linear cuts on the neck. All the kerf floors and most of the surrounding cortical bone were soil stained the same shade.

CHAPTER 5: DISCUSSION

A human burial contains more anthropological information per cubic meter of deposit than any other type of archaeological feature.
Peebles (1977:124).

Introduction

The following section discusses the information obtained from the osteological and taphonomic analyses of all the skeletal material sampled from Marcahuamachuco and Cerro Amaru, in an attempt to answer the research goals outlined in Chapter One (see Section 1.1, p. 17). An ultimate goal of this research is to use these findings are a template for interpreting other Andean sites, which contain similar mortuary architecture.

5.1 Osteobiographical Analysis

The following section analyzes all of the osteobiographical information obtained from the three different burials contexts found at the sites of Marcahuamachuco and Cerro Amaru: (1) Wall burials inside niched halls at Marcahuamachuco; (2) A burial located underneath the Castillo at Marcahuamachuco; and (3) Burials located inside the Mausoleum at Cerro Amaru.

5.1.1 Marcahuamachuco Wall Burials

Skeletal material recovered from the niched hall 63H, came from at least five individuals. All three main areas of the human body, the skull, axial skeleton and appendicular skeleton, are represented. The sampled skeletal remains include robust long bones, fragile ribs and small bones such as the pisiform, and teeth. Due to the variety of the bones analyzed, at least one of the interments was likely a primary deposition.

Of all the MNI assessments, the material from the niched hall 63C1 proved the most challenging due to the shear quantity of bone recovered from this context. The final MNI was determined to be 13 based on the number of temporal bones that were sideable and which included male or female defining characteristics. Nearly every bone in the human body was represented at least once. The occipital, long bones and os coxae were the most frequently represented, aided by their size and robusticity. These findings can be explained by differential deposition, i.e. some interments were primary and others were secondary, and by differential preservation, i.e. the robust bones have a higher probability of surviving taphonomic and human intervention.

In the sample from 63H, there are bones from at least one juvenile/young adult male, two adult females, one middle adult male and two older adult males. There were no bones that appeared to represent fetal or juvenile individuals. In contrast to the wall niches of 63H, there is a wider range of ages found in the 63C sample. The skeletal material represents at least two juveniles, a male and a female juvenile/young adult, one adult of unknown sex, four female adults and four male adults. Noticeably absent, were fetal remains.

In general, the lack of fetal and/or juvenile remains may be attributed to sampling bias, lack of preservation or a deliberate decision made in antiquity to only inter those who had achieved adult status inside the walls. It should be noted that the lack of fetal bones is often associated with poor preservation; however, dental crowns and the petrous portion of the temporal are extremely dense and would likely have been present in the assemblage if individuals of this age had been originally included. Therefore, it is more likely that fetuses were simply not included in the interments inside the niched halls of Marcahuamachuco and that they were buried in an unknown location elsewhere on the site.

Elements identified as having female sexable characteristics were solely based on the larger long bones of the body, namely the humerus, tibia and femur. In contrast, elements identified as male sexable characteristics included a combination of cranial elements (mandible and calvarium) and long bones, i.e. the tibia and femur. Noticeably infrequent and/or absent in the sample were intact os coxae, one of the most valuable bones in sex determination.

The skeletal samples from 63H and 63C had very few smaller bones, such as the bones of the hands or feet. The fact that larger long bones and cranial fragments were the predominant bones found in the skeletal samples could identify these as secondary burials. These bones are easily recognizable and are the easiest to move from one location to another.

Since the skeletal remains were interred inside a building that was being used by the individuals at Marcahuamachuco, it would stand to reason that they would prefer dry bone to decomposing corpses. If, however, the site was only seasonally occupied, smell may not have been a determining factor in the burial custom. For instance, the bodies could have been interred inside the walls to decompose prior to the inhabitants vacating Marcahuamachuco for a several months.

Another possibility is mummification for ease of transport. Since the site of Marcahuamachuco was considered a ceremonial centre, it would stand to reason that the site would be a revered place to spend eternity. If an individual died while away from the site for an extended period, the corpse would need to be prepared in such a way to ensure that the body would maintain its integrity for the duration of the stay at the different locale and the eventual pilgrimage home.

As Nelson (1998) found at the ancient site of San Jose de Moro, mummification was also a pragmatic solution to transporting a corpse over long distances, since dry desiccated bodies are considerably lighter than 'fresh' cadavers. The ancient Peruvians were very limited in their hauling capabilities since they lacked the technological advancement of the wheeled cart, and their largest domesticated pack animal, the llama, can only carry a load of approximately forty pounds (Nelson 1998). Therefore, the bias towards long bones and cranial fragments could have occurred as a result of ancient burial customs and practices, sampling bias, human disturbance and/or looting.

The stature estimates of the individuals from 63H included a single male stature estimate of 159.7cm and a range of stature estimates from 139.7 to 152.1cm, with a mean of 144.7cm, for females. Stature for males from 63C ranged from 148.9 to 159.6cm, with a mean of 152.6cm and from 131.9 to 152.1cm, with a mean of 144.5cm for females. When comparing the obtained stature values from 63H and 63C1 to the stature ranges and means from other ancient Peruvian populations published in Verano (2003a:88)[25] and Murphy (2004:97-98)[26], it is apparent that most individuals interred in wall burials at Marcahuamachuco fell within what is considered the normal height range (see Table 5.1). Growth and development studies have demonstrated a link between reaching full growth potential and adequate health (Steckel 1995). Thus, it appears that most of the individuals obtained their full growth potential. The exception appears to be ID 792, since the height

[25] Male stature range is 148-168 cm and the female stature range is 138-156 cm.
[26] Male stature range is 151.7-168.7 cm and the female stature range is 137.6-159.2 cm

of 137.8cm and 131.9cm, male and female formula respectively, is several centimetres below the 'normal' range of growth in any population.

Sample		Males		Females		
Location	Culture	Quantity	Mean Stature (cm)	Quantity	Mean Stature (cm)	References
Puruchuco – Huaquerones	Inca	57	160.0	36	150.0	Murphy 2004
Machu Picchu	Inca	8	157.0	10	148.3	Verano 2003a
Quechua: Cuzco, Peru	Modern	243	158.8	85	146.3	Stinson 1990
Quechua: Nuñoa, Peru	Modern	50	160	50	148	Frisancho and Baker 1970
Pacatnamú	Moche	53	157.6	52	146.8	Verano 1997
El Brujo	Lambayeque/Sicán	-	159.0	-	155.0	Farnum 2002
Sicán Capital	Lambayeque/Sicán	-	161.9	-	159.7	Farnum 2002
Chicama	Late Prehistoric	1000	157.2	350	144.7	Hrdlicka 1938
Nasca	Nasca	33	160.1	32	150.0	Kellner 2002

Table 5.1: Comparable stature estimates from coastal and highland Peruvian samples – calculated with unmodified Genovés (1967) formulae[27].
Taken from Murphy (2004:98) and Verano (2003a:89).

Subadult growth and adult stature are sensitive indicators of environmental conditions and nutritional status (Eveleth and Tanner 1990; see also Murphy 2004:85); thus, it is possible that ID 792 was subjected to periods of stress, disease and/or inadequate nutrition during their period of growth and development. It is also possible that the bone actually belonged to a juvenile individual, since ID 792 had the living stature estimated from only the shaft of a femur. Both nutrition and misclassification could account for the fact that the stature estimate appears as an outlier compared to the other stature estimates.

In regards to trauma and health in the skeletal material recovered from 63H, there was evidence of eburnation, osteoarthritic lipping and osteophytic activity on several vertebrae, and eburnation on a femur and a first metacarpal. Carious lesions were the dominant dental pathology, with only one mandible that exhibited ante-mortem tooth loss. The sample from 63H also had one incident of blunt force trauma, which was

[27] Since these published stature estimates utilized the adjusted Genovés formulae (Genovés 1967; del Angels and Cisneros 2004), their stature estimates and/or ranges are slightly overestimated.

recorded in a young adult male frontal bone. The trauma was likely the result of interpersonal violence.

Most of the trauma found in the skeletal sample from 63C consisted of fractures; two healed fractures to metatarsals, one fracture in the process of remodelling in a tibia, and a healed fracture to the clavicle. The high incidence of fractures and trauma observed in the skeletal populations from 63H and 63C1 is likely a reflection of the rugged terrain and steep mountain slopes characteristic of Marcahuamachuco. It must be remembered that the skeletal samples are extremely fragmentary and weathered, thereby making it hard to estimate the actual prevalence of trauma within the population. Other highland sites such as Inca burial caves near to Machu Picchu, Paucarcancha, Patallacta and Torontoy exhibited similar high rates of trauma and fractures within the skeletal samples (Hrdlicka 1914; MacCurdy 1923), possibly consistent with higher incidences of interpersonal violence and warfare (Verano 2003a).

Degenerative disease such as osteophytic activity and osteoarthritis were only observed on vertebrae sampled from 63C. Dental disease was present, with numerous teeth exhibiting different severities of carious lesions. Several mandibles also had extensive tooth loss and alveolar bone resorption, with a few instances of active lesions in the alveolar bone (abscesses). Overall, the skeletal remains appear fairly healthy, with only a few instances of bone pathology.

The prevalence of carious lesions, abscesses, and antemortem tooth loss in the skeletal samples taken from 63H and 63C, can be indicative of carbohydrate rich foods (Larsen 1997; Verano 2003a). Dietary carbohydrates are not the only contributor to dental disease in the Andes. Although no examples were found in the skeletal samples from Marcahuamachuco, periods of stress and malnutrition in children are often reflected in the teeth of children, i.e. LEH. Coca leaf chewing has also been directly linked to caries, posterior tooth loss and gum inflammation in Prehistoric Andean populations (Aufderheide 1996; Indriati and Buikstra 2001). Some of the antemortem posterior tooth loss and buccal caries could have been associated with coca chewing. However, given the state of the collection, it was impossible to pair any of the mandibles/maxillae together. Therefore, the characteristic triangular caries pattern of heavy coca could not be demonstrated (Indriati and Buikstra 2001).

ID 583, from niched hall 63C, appears to have undergone a trepanning episode. Following a comprehensive study of Peru, Verano (2003b) concluded that evidence of trepanation has been observed in the archaeological record in almost all regions of the Peruvian Andes, dating from approximately 400 BC to AD 1532 (the Late Horizon). Circular grooving trepanning has also been found in skeletal material from the nearby Peruvian highland site of Kuelap, dated to AD 1100-1470 (Nystrom 2007). This would be the first recorded instance at Marcahuamachuco.

5.1.2 The Castillo

The skeletal remains recovered from underneath the Castillo at Marcahuamachuco, represented a tall young female and a fetus almost at full term, i.e. 36 to 38 week gestation. There was a discrepancy between metric sex determinations on the adult individual, i.e. both male and female results were generated. However, given the morphological assessment, the context of the remains, and the couple of female metric assessments, the remains have been determined to have belonged to a single adult female. The differing results can be explained through normal human variation and/or problems with the metric methodology as it relates to ancient Peruvian populations.

Given the general context of the grave, along with other recovered material from within the same context, i.e. fetal bones that had not reached complete gestation, it is possible that the fetal remains were located within the womb of the individual buried under the Castillo. Although expensive and not always conclusive (Faerman *et al.* 1997, 1998; Götherström *et al.* 1997; Mannuci *et al.* 1994; Safont *et al.* 2000), fetal DNA could confirm or refute if the adult was in fact related either directly, i.e. mother or indirectly via mitochondrial DNA patterns.

The stature estimates of 153.6cm and 155.6cm from the femur and tibia respectively, are more consistent with the female stature averages from the North Coast (Farnum 2002), than they are with the stature estimates from Machu Picchu (Verano 2003a). Therefore, it is possible that the female buried underneath the Castillo had some ancestry consistent with Coastal populations, i.e. her ancestors or parents' were from the coast and/or she migrated to the highlands herself, possibly through marriage. However, this can only be confirmed with further detailed analyses.

Of all the various adult bones recovered, there were two obvious missing skeletal elements, skull bones and ribs. Due to depth limitations (almost 9 metres below datum) and safety concerns regarding the walls collapsing, the excavation trench was not expanded. Two viable reasons behind the missing skull could be: (a) The skull was simply not recovered, since it was beyond the confines of the excavation trench; and (2) The skull may have been kept for trophy purposes. The taking of trophy skulls was a prevalent practice in ancient Peru, as witnessed through Andean iconography and the archaeological record (Andrushko *et al.* 2000; Drusini and Baraybar 1991; Owsley *et al.* 1977; Pickering 1985; Smith 1993, 1997; Verano 1995, 2001).

Following an analysis of eighty-four Nasca trophy heads, Verano (1995) demonstrated that approximately 85 percent of all trophy skulls belong to males between the ages of 20 and 50. Of these 85 percent, most of the trophy heads are believed to have been war mementos taken from conquered enemies. In contrast, females accounted for only six percent of the sample. There were several incised cut marks located on the axis vertebra of 63Q3, which could be consistent with dismemberment and/or trophy taking. However, given the context and apparent significance associated with the burial, it seems unlikely that the skull would have been removed as a war memento or trophy.

Dismemberment could also account for the absence of ribs. Several of the joints displayed evidence of intentional human modification, in the form of cut marks. If the body was dismembered, the larger more robust bones could have been favoured. Also, the interment under the Castillo could have lost the ribs, if the burial was secondarily deposited in the grave.

5.1.3 The Mausoleum

The mausoleum contained skeletal material from all areas of the human skeleton, including cranial, appendicular and axial elements. Although the collection as a whole is badly water damaged and poorly preserved, fragile elements such as phalanges and a piece of the ethmoid bone were all observed and recorded. These observations certainly do not rule at the possibility of a combination of secondary and primary burials; but, it becomes more likely that the mausoleum loft and floor did contain some primary interments.

In addition to the large wooden loft, the mausoleum housed three small stone cists, which contained human skeletal remains. Of the three cists, only Cist 1 appeared to be undisturbed since antiquity. The other two cists had burned fragments and interspersed archaeological evidence of *huaqueros* destruction. Therefore, only Cist 1 was treated as a separate entity from the rest of the Mausoleum.

Other than a single piece of the petrous portion of the temporal, the only skeletal elements found inside of Cist 1, were teeth. Vessel D, with an MNI of one, contained only tooth crowns that displayed little to no apparent occlusal wear. With the exclusion of a small piece of the petrous portion of a temporal, Vessel T contained mostly tooth crowns and three pieces of tooth root. Several of the teeth exhibited a polished pattern of enamel where the teeth used to connect to the root.

Most of the identifiable and numerous crowns from Vessel T had little to no occlusal wear visible. However, one unsided/unidentified molar exhibited severe dental attrition. Hence, at a minimum one older and two younger individuals contributed teeth to the assemblage inside Vessel T.

There is evidence that selected human body parts such as heads, skulls, teeth, and long bones were occasionally collected and modified for ritual or personal use (Verano 2001). Therefore, it is possible that the abundance of teeth in Cist 1 represents a cache or religious offering. Cerro Amaru has been identified as a religious centre (Topic and Topic 1992; TL Topic 1991), so it is likely that offerings would be made on the site, especially within an area where ancestors were housed.

When looking at the Mausoleum as a complete unit, it is apparent that it contained a MNI of at least 14 individuals. This assessment was based on the quantity of femora that was examined from the sites of 64A2, 64A6 and 64A7. With the exception of fetal remains, all age ranges appear to be represented, i.e. bones from individuals ranging in age from juvenile to adult.

In the skeletal population, bones belonging to at least one juvenile, two young adults of unknown sex, one middle adult male, one old adult female, and one older adult of unknown sex were recovered. Due to the extreme taphonomic alteration of the skeletal assemblage, i.e. fragmented and 'bark-like', very few osteological analyses could be completed. Out of at least 14 individuals, only eight had bones with enough identifiable characteristics to have their biological sex determined, i.e. three male individuals, and five females. Unfortunately, taphonomic processes ensured that no bones were complete or recognizable enough to complete an analysis on stature. Therefore, no data are available on the height of the individuals buried inside the Mausoleum.

In regards to health, tooth loss and carious lesions were the predominant visible ailments, with one mandible still displaying an abscess in the alveolar bone. Most of the carious lesions observed were on the mesial/distal portions of the enamel. Only one incisor, ID 388, displayed the characteristic enamel defects of LEH, out of all the teeth analyzed in this study, including the teeth from Marcahuamachuco. No other bones showed any sign of skeletal stress.

ID 224, a talus, displayed evidence of bone degeneration. The bone exhibited extra osseous growth on the calcaneal articular surface and some lipping on the lateral side of the posterior calcaneal articular surface. Without an analysis of the rest of the skeleton, it is impossible to determine if the deterioration of the bone was the result of old age and/or a repetitive stress injury.

The Mausoleum skeletal population had one visible sign of trauma. Out of four calvaria examined, only ID 208, a young adult of unknown sex, exhibited a peri-mortem blunt force trauma injury to the occipital. Several radiating fractures were directly linked back to the point of impact. There did not appear to be any signs of healing. Such a substantial blow to the occipital bone likely resulted in death.

Due to the amount of carious lesions and antemortem tooth loss seen in the teeth of the individuals recovered from within the Mausoleum, it is highly probable that their diet consisted of carbohydrate rich foods. With this type of subsistence pattern, caries, abscesses, and antemortem tooth loss are prevalent (Larsen 1997; Verano 2003a). Similar to the teeth recovered from within the niched halls of Marcahuamachuco, some of the buccal caries could be indicative of coca chewing. However, without the ability to match maxillary and mandibular dentition to look for the characteristic triangular caries pattern, it is impossible to make a definitive claim about the use of coca.

5.2 Taphonomic Analysis

The following section analyzes all of the taphonomical information obtained from the three different burials contexts found at the sites of Marcahuamachuco and Cerro Amaru: (1) Wall burials inside niched halls at Marcahuamachuco; (2) A burial located underneath the Castillo at Marcahuamachuco; and (3) Burials located inside the Mausoleum at Cerro Amaru.

5.2.1 Marcahuamachuco Wall Burials

The skeletal samples from 63H and 63C1 had a wide range of different taphonomic processes affecting the overall condition of the bone. The most destructive non-cultural taphonomic processes included widespread water damage, root etching and fragmentation. The environmental conditions at Marcahuamachuco, which include heavy rainfall, high humidity, an annual freeze/thaw cycle, and a high water table (Shaughnessy 1984; Geurts 1982), are important factors in the poor rate of preservation of the skeletal remains. These taphonomic processes did not affect all bones equally, as there is differential preservation rates in the skeletal material from 63H and 63C, i.e. a few bones are extremely well preserved, with minimal taphonomic destruction. Other non-cultural taphonomy observed, was evidence of recent rodent activity, classified by the parallel grooves and lighter non-stained exposed cortical bone.

Several incidences of intentional human modification were observed on the skeletal samples recovered from 63H and 63C1. Two bone fragments, possibly non-human, recovered from 63C were also blackened and charred, consistent with having been exposed to a flame post-mortem. No other bones in the skeletal samples from 63H or 63C exhibited evidence of heat damage and/or fire exposure.

Most of the incised marks are centralized around the knee. The marks do not appear to have a v-shaped kerf, nor do they appear to have been caused by a sharp instrument. The marks display a very wide u-shaped kerf, more consistent with a larger chopping tool (Symes *et al.* 2002).

The large marks could have resulted from an episode of dismemberment. As previously stated, since the individuals were being sealed inside niches in great halls, it would make sense that a fresh body was not inserted into the niche. First, there is the problem of odour, which would seep into the air during decomposition. If the hall was being used continuously by the inhabitants of Marcahuamachuco, smell would have been an issue. Second, the fluids from putrefaction would have possibly oozed out the wall, making the rooms of the hall unusable for periods of time. Third, the smell and the decaying flesh would likely have summoned vermin and other pests associated with decomposition, quite possibly making the rooms unfit for human habitation. Which, it must be acknowledged that our modern sensibilities may not reflect the attitudes of ancient Peruvians to death and decay. However, at the very least, this arrangement would be unsanitary. Finally, logistically speaking, it is much easier to insert a dismembered skeleton into a hole in the wall.

In contrast to an episode of violent human modification, the author posits that the large incised u-shaped marks could have resulted from tightly wrapped cord used to bind the knees closer to the body. Since ancestor worship through mummified remains, has been purported in the Andean highlands and in particular the Huamachuco area, via ethnohistoric accounts and archaeological data, the interments inside the walls of the niched halls could have been tightly flexed mummified individuals. To ensure the mummy is tightly bundled, the cords are pulled extremely tight and often leave distinct grooves on the skin. These marks have been found in the same location on the skin of mummified individuals in the Huamachuco area (Guillén *et al.* 2009); therefore, if the bones had been completely saturated with water and subsequently shrank during drying, it is possible that the cords could have etched themselves onto the bone.

In the skeletal assemblage from 63C1, two young adult male calvaria displayed cut marks, ID 582 and 583. ID 582 displayed six linear cut marks on the frontal bone, roughly in line with the scalp. The longest mark was approximately 10mm in length. The marks were thin, and appeared to have a v-shaped kerf, consistent with a sharp blade. The location and pattern appear to be consistent with scalping (Bridges 1996; Owsley 1994). However, no other parallel linear marks were observed around the circumference of the cranial vault.

ID 583, the same individual discussed earlier in the context of trepanation, had several lines etched into the ectocranial surface of the calvaria that were stained the same colour as the surrounding bone. One cut mark ran along the sagittal suture, across the left parietal and down the left side of the occipital. The other is a 'V' shaped mark starting on the right parietal, crossing to the frontal, and ending on the left parietal. The marks are long and have a wide kerf floor. There are no radiating or concentric fractures consistent with a blunt force injury, nor is the pattern consistent with sharp force trauma. The author is unsure of the type of instrument used to cause the marks, although it cannot be ruled out that they were caused at the time of the trepanning incident.

The data obtained from the skeletal samples taken from wall niches 63H and 63C, indicate that these burials were primarily secondary interments. Hence, the individuals buried inside the walls of the niched halls likely died elsewhere. They were then mummified tightly into a flexed position and brought back to the niched halls as a bundle. The bundles were then placed inside the walls, and using mortar and stones, the pre-made niches were sealed.

5.2.2 The Castillo

Out of all the skeletal remains examined for this thesis, the remains from underneath the Castillo exhibited the least amount of non-cultural taphonomic changes. There did not appear to be any signs of obvious water damage or cortical damage from the freeze/thaw cycle. The lack of obvious signs of weathering is directly related to the deep burial pit the remains were buried in. Since the remains were located almost nine metres below the surface, they were protected from the elements and the affects of the climate.

In contrast, cultural taphonomic processes were abundant throughout the entire skeletal sample of adult remains. Comparable to the burials inside the niched halls of Marcahuamachuco and inside the mausoleum at Cerro Amaru, the remains recovered from underneath the Castillo have a high frequency of intentional bone modification. The cut marks are all centralized around key joint surfaces of the body, i.e. the axis vertebra, the elbow, the humeral sockets, femoral heads, and the knee (see Figure 4.26).

The marks are not healed nor are they in a single location, so it does not appear to be an act of warfare. There are cut marks present on the superior articular facets of the axis vertebra, which could be consistent with intentional decapitation (Andrushko *et al.*

2000; Smith 1997; Verano 2001, 1986; Zimmerman 1997). The tool used to create the marks would have been sharp, since the kerf floor is v-shaped and narrow.

There are no visible linear transverse marks on the anterior portion of the cervical vertebrae, so it does not appear as if the individual had their throat slit. There is no evidence of burning, pot polish, peri-mortem fractures or anvil abrasions on any of the recovered skeletal remains. Therefore, the nature of the cut marks is inconsistent with either exposure to fire or cannibalism.

Acts of defleshing are characterized by a random dispersal of cut marks over the entire surface of bone and at major muscle attachment sites. All the cut marks from 63Q3 display a clear pattern of dispersal, focusing on the epiphyses and the major joints. According to Symes *et al.* (2002:407), "If cut marks follow the contour of a bone onto different surfaces, it is more likely an act of dismemberment rather than an attempt to kill the victim". As is clearly displayed on the right femur, ID 567, the mark severs the medial condyle and penetrates the lateral condyle. Therefore, it is the belief of the author that the individual was intentionally dismembered.

Although there is evidence for the manufacture of metal saws prior to the eighth century BC in the Old World (Symes *et al.* 1998), they were unknown to the inhabitants of the New World until European contact (Verano *et al.* 2000). Therefore, the shaved appearance on some of the larger more robust bones was likely caused by a tool more consistent with a tumi or stone axe (Seed 2000).

In contrast, the rounded more chiselled marks found on the anterior and posterior aspect of the femoral head, ID 504, could have been caused by a tool similar to modern-day pliers and/or a vise that gripped the femur while it was separated from the pelvis. Through the application of force, the tool could have etched itself into the bone.

Therefore, the young female buried under the Castillo was subjected to post-mortem modification. The cut marks on the second cervical vertebra axis are consistent with decapitation. The cut marks at all the major joints of the long bones are indicative of an episode of dismemberment and/or sacrifice. Although it cannot be conclusively proven that the individual was dismembered as a sacrificial offering, especially since the cranial elements are not present, the young, possibly pregnant, women was certainly dismembered and was treated as an offering in a very exceptional way.

5.2.3 The Mausoleum

The small identifiable collection of bones from within the larger population is largely due to poor preservation, burning of the mausoleum in antiquity, as well as severe fragmentation. Although most of these problems plagued the entire skeletal sample examined for this thesis, the fragmentation and taphonomic damage to the bones was more extensive in the mausoleum than either of the burial styles sampled at Marcahuamachuco.

The lack of preservation of the skeletal material could be a consequence of the greater amount of water that permeates the site of Cerro Amaru. Although the area that contains both Cerro Amaru and Marcahuamachuco receives heavy rainfall during the rainy season, December to March, Cerro Amaru is also known for three deep wells (Topic and Topic 1983). These artesian wells are known to contain water year round; thus, making the possibility of a high water table at the site extremely likely. Further excavation of the wells, as well as a geological study of the surrounding area, would shed more light on possibility.

The deterioration of the skeletal material was also aided by cultural taphonomic processes. The mausoleum was subjected to an intentional episode of burning (Topic and Topic 1984). As previously mentioned, several of the bones exhibited a charcoal black appearance that is consistent with having been exposed to fire. Again, the condition of the skeletal remains limits the understanding of the fire. It was impossible to determine if other bones were only exposed to the fire indirectly, as no other bones exhibited visible signs of heat exposure, other than the characteristic charring. No burnt skeletal material was found inside Cist 1, as it had remained sealed until it was excavated. Therefore, it can be concluded that the fire occurred after Cist 1 was sealed.

The bones were also crushed by large stones, as farmers continuously removed fallen rocks from the surrounding fields and placed them on top of where the mausoleum once stood (Topic and Topic 1992). However, the rocks were a mixed blessing. The Topics (1992) postulate that the only reason the mausoleum had not been completely destroyed was because the rock pile prevented the land from being used as an agricultural field.

Intentional human modification was also seen in the skeletal assemblage recovered from inside the mausoleum. Preservation quality issues prevented an accurate assessment of where the lesions were located on the bones. All marks were stained the same colour as the surrounding bone; therefore, the taphonomic changes did not occur recently. Most of the cut marks were found on what appeared to be the femoral shaft. No identifiable pattern was observed. However, the marks did not appear to be consistent with the shallow/wide u-shaped grooves found in the skeletal samples taken from inside the wall niches at Marcahuamachuco. Nor did they appear consistent with the shaved appearance of the cut marks found in the remains from underneath the Castillo that were attributed to dismemberment.

Without a clearer view of the cortical bone, it is hard to determine the potential motivation behind the cut marks. The most likely candidate is defleshing, since the cut marks appear random and/or at the site of major muscle attachments. There potentially could have been more cut marks in the sample in ancient times, but their existence would have been obliterated by the bones exposure to the elements. Thus, it does not appear that the cut marks are consistent with dismemberment and/or human sacrifice.

5.3 Burial Analysis

The following section analyzes the different burial customs from the three different burials contexts found at the sites of Marcahuamachuco and Cerro Amaru: (1) Wall burials inside niched halls at Marcahuamachuco; (2) A burial located underneath the Castillo at Marcahuamachuco; and (3) Burials located inside the Mausoleum at Cerro Amaru.

5.3.1 Marcahuamachuco Wall Burials

The skeletal analysis of the remains recovered from burials inside the walls of niched halls illustrates that both males and females were interred. With the exception of fetal remains, all age categories were represented. The individuals appeared to be healthy, with little evidence of chronic infection.

Even though most of the skeletal material was badly damaged and fragmented via non-cultural taphonomic processes, evidence of intentional human modification was still observed. Since the cut marks on the lower long bones are focused around the knee, it is suggested that the individuals underwent some form of dismemberment and/or were subjected to cord tightening during the mummification process. Mummification, textile wrapping and cording the corpse to maintain a fetal position, are all burial customs known to have occurred in both the Huamachuco area (Guillén *et al.* 2003), and the highland site of Kuelap (Muscutt 1998). However, none of the osteological literature from other highland sites mentions a similar 'cording' pattern on the skeletal remains.

5.3.2 The Castillo

The context and materials associated with the remains must also be considered in conjunction with the cultural taphonomic assessment. A small offering of turquoise and *Spondylus* shell was discovered several meters above the skeletal remains. These exotic and valuable items were used as an elite status symbol by ancient Peruvians. In particular, the *Spondylus* shell was valuable since it would have been imported from the coast of Ecuador.

The interment was the only evidence of human skeletal remains underneath the entire Castillo. The burial of skulls and/or other skeletal elements in ceremonial architecture is an ancient practice in the Andes that archaeological evidence dates back to at least the Early Horizon at sites such as Chavín de Huántar (Burger 1984; Verano 2001). According to the Topics (1989), the Castillo represents the ceremonial heart of the site, and was likely the locus of political and religious power for the people around Marcahuamachuco.

Interspersed with the human skeletal material was a minimum of eighteen articulated camelids. Camelids were the largest domesticated animal in Peru, and would have been considered an expensive and valuable commodity. Camelids were used to provide wool for clothing and/or food. Although dismemberment on its own does not automatically mean that a human sacrifice took place, the combination of very rich grave goods and evidence of post-mortem dismemberment, are most consistent with an important sacrificial offering to the gods. According to Frame (2001), the sacrifice of blood or life essence during the course of building dedication represented fertility. If the inferences made from the osteological assessment are correct, the pregnant female individual would have been the ultimate sacrifice towards fertility.

According to Verano (2006:9), there are two main patterns of human sacrifices found at Prehispanic Peruvian sites: “"(1) carefully-arranged burials of children or adolescents accompanied by elaborate grave goods as offering to temples or retainers in high status tombs, and (2) male captives buried in non-mortuary (...) contexts without grave goods or considerate treatment of the body”. However, there are several examples of female sacrificial victims have been recorded in Peru. At the site of El Brujo in the Chicama River valley in northern Peru, several female sacrifices were found with cord ligatures still preserved (Gálvez and Briceño 2001). Inside a high status male burial at the site of Lambayeque (Sicán), an adult female was strangled with a fine cotton cord (Verano 2001). At the same site, a sacrificed Moche woman was found in an isolated pit strangled with a coarse rope made of *cabuya* fibre, a strong plant fibre normally used for fishing nets and utilitarian cordage. She was buried in a simple pit with a camelid (Verano 2001). No organic fibres were recovered from 63Q3.

From the archaeological evidence found at other Prehispanic Peruvian sites, mainly from the coast where preservation of organic material in the arid environment is fantastic, it has been found that men are typically the ones who are dismembered (Sutter and Cortez 2005; Verano 2003a), and women typically have ligature and/or strangulation type deaths (Uhle 1903). In fact, women appear to most often be sacrificed as retainers to a more prestigious male, so that they may accompany and/or help him in the afterlife. With regards to sacrifices during the construction of sacred buildings and temples, it has often been found that children are the ones sacrificed to the Gods (Eeckhout and Owens 2008).

Perhaps the female victim underneath the Castillo at Marcahuamachuco had more in common with the famous Inca ‘ice maidens’ that Reinhardt and colleagues found on several different mountain peaks throughout the Tahuantinsuyu territory (Ceruti 2003). Ceruti (2003) believes that the sacrificial females were chosen for their age, physical beauty, and their social origins. Similar to retainer burials, the ‘ice maidens’ were often murdered by strangulation; however, many ‘ice maidens’ also showed signs of cranial trauma (Reinhard 1997, 1998). Unfortunately, the cranium and the hyoid are missing from the young female buried under the Castillo, so it is impossible to definitively determine a cause of death.

5.3.3 The Mausoleum

The skeletal analysis of the remains recovered from inside the mausoleum, illustrates that both males and females were interred. With the exception of fetal remains, all age categories were represented. The individuals appeared to be healthy, with little evidence of chronic infection. Even though most of the skeletal material was badly damaged and fragmented via non-cultural taphonomic processes, evidence of intentional human modification was still observed.

Built above the floor of the mausoleum and supported by a low stone wall, was a wooden loft (see Figure 2.10 and 2.11). In conjunction with the fine textile fragments and valuable grave offerings, it is believed that the loft was a repository for mummies and their grave offerings. Within the walls of the mausoleum, the Topics (1984) also discovered large quantities of decorated ceramics, which display noticeable influences from Wari culture and from the South Coast. Although the Topics (1984) have found it difficult to distinguish between imports, non-local artisan pieces created from materials available locally, and imitations created locally, these findings suggest an extensive trading network.

In combination with the skeletal material, excavations of the Mausoleum unearthed rare and expensive items. The main level of the Mausoleum contained: Burnt textile, three nested bowls, copper topus, burnt corn kernels, blackware bowls, ceramic bottle, beaker, obsidian flakes, gold and silver thimble-like objects possibly from a pair of gloves, fourteen silver disks, copper nails, spiral copper pin, silver pin, and a pyrite mirror (Topic and Topic 1984). Looking at the shear quantity, not to mention the quality of cultural remnants associated with the Mausoleum (see Table 2.1), it is apparent that it was used for high-status burials. Therefore, since there was no discrimination against age and/or sex, status within the population buried at Cerro Amaru must have been ascribed.

5.3.4 Understanding Marcahuamachuco and Cerro Amaru Burial Customs

The sites of Marcahuamachuco and Cerro Amaru provided a plethora of different and impressive stone mortuary buildings, complete with differing burial rituals and/or customs. The first are four large burial towers found at Marcahuamachuco (see Figures 2.6 and 2.7), which are described and illustrated by Loten (1987). The four towers are inferred to be burial structures based on similar construction and style found at other highland Peruvian sites. The burial towers themselves standout from the landscape, and are visible from many miles away. Unfortunately, since they have been open for centuries, no human skeletal remains have been found inside the structures at Marcahuamachuco. However, they are still indicative of another different burial custom other than the niched halls, the Castillo and the mausoleum.

In contrast to the currently skeletally deprived burial towers, the seemingly utilitarian niched halls at Marcahuamachuco house a cemetery of human skeletal remains within their walls. Wall burials are not a burial custom that is unique to the site of Marcahuamachuco Burials have also been found in the walls of structures at other highland sites, i.e. Kuelap and Pikillacta.

Osteologically, the skeletal sample indicates that male and female individuals, ranging in age from juvenile to older adult, were interred inside the walls. With regards to stature, it appears that the individuals interred inside the walls of the niched halls were of average height comparable to other Pre-Columbian Highland sites. In contrast, the young female buried beneath the Castillo was taller than the average highland female. Her height is much more consistent with the taller female statures of coastal populations. As mentioned previously, her tall stature possibly reflects the fact that she was originally from another ancestral population.

Taphonomically, there are cultural modifications on the skeletal material from the wall niches at Marcahuamachuco that appear to be intentional, around the knee area of the leg. These marks are consistent with cording, a burial practice that that uses rope secured around the knees and back to ensure the deceased individual remains in a flexed position for burial. The cording typically occurs during the mummification process. This form of mummification has been recorded in the Andean highlands, including the Huamachuco area (Guillén *et al.* 2009).

As Morris (1991) found, funerary monuments and places of ancestor veneration, are typically constructed in strategic terrain as a territorial marker. The location of Marcahuamachuco ensures that the site dominates the surrounding countryside and the niched halls are believed to have been constructed as a location for feasting and ancestor worship. If the inhabitants participated in ancestor veneration, it would have reinforced the group dynamic and solidified traditional socio-political arrangements.

Therefore, if a number of ayllu were concerned with maintaining the cemetery walls, each ayllu would have constructed and maintained their specific section that reflected their ancestors (Moseley 2001). From the pattern of wall destruction by *huaqueros*, the Topics (1987) believe that looters have been searching for specific spots on the walls where burials may have been hidden. Therefore, it is likely that during the construction of the hall itself, the niches were roughened in to be used in the future. This would imply that the niched halls were originally built with the foresight that they would be used as a cemetery.

Moreover, it still remains uncertain what proportion of the population actually lived at the highland site of Marcahuamachuco. In many highland areas in the past and present, the population is dispersed over the entire surrounding landscape, living in small villages and hamlets. Groups only gather together for short sporadic gatherings for public and/or ritual celebrations (Burger 1992). Further research, isotopic research and DNA analysis could elucidate if this form of ayllu organization existed in the niched halls and what percentage of the population was indigenous to Marcahuamachuco.

Similar to the burials inside the walls of the niched halls, the Mausoleum provides evidence to support the mummification of individuals, i.e. the vast amounts of funerary textiles. Some of the bones do display cut marks, but there does not appear to be a distinct pattern. Without further taphonomic and/or cultural information, it does not appear that the individuals interred inside the Mausoleum were dismembered or sacrificed. Taphonomically, the bones are a repository of information about what kind of effect the environment has on bone. For this reason, a more detailed analysis of the funerary practices is impossible.

However, what can be determined is that inside the Mausoleum, both males and females, ranging in age from juvenile to adult, were included in the burial house. Also, in combination with the rich and diverse grave goods, it can be assumed the individuals did maintain some ascribed status in life, and retained it in death. For these reasons, the author posits that the bones could represent a specific wealthy extended family or ayllu. DNA testing could elucidate if these individuals were of the same family and/or shared a common maternal line.

In contrast to multiple interments found in both the wall niches at Marcahuamachuco and the Mausoleum at Cerro Amaru, the Castillo burial only contained a single adult female, and potentially her unborn fetus. The remains underneath the Castillo also do not share the large rounded kerf floor of the trauma around the knees indicative of the cord wrapping and mummification. Instead, the body appears to have been deliberately mutilated and dismembered, with cut-marks at all the major joints.

The Castillo grave offerings are also very different from those found with the bodies interred inside the niched halls and the mausoleum. The niched halls contained very few grave goods, which could be indicative of the burial customs and/or the extensive looting that has taken place over the centuries. The Mausoleum had considerably rich and diverse grave offerings, which included but was not limited to gold and silver pieces. In regards to actual trinkets of value, none of the other burial contexts compared to the Mausoleum in either quantity or quality.

In contrast, the burial under the Castillo was accompanied by three distinct offerings, each rich in their own right. The first was a substantial amount of turquoise, which was considered a precious and valuable stone. The second offering was a significant amount of *Spondylus* shell, which was a rare commodity since it would have been imported from the Coast of Ecuador in small quantities. Finally, the most significant of the grave goods was the minimum of eighteen articulated llamas that were placed around the young female and fetus. Llamas were the largest and therefore most valuable, domesticated animal known in Prehispanic Peru. It offered both sustenance, i.e. milk and meat, as well as wool for clothing; two of the most basic of all human needs. In conjunction with the dismembered remains, and the shear depth below the constructed Castillo, it is extremely likely that the young female and fetus represents the only sacrificial victims currently known at the sites of Marcahuamachuco and Cerro Amaru.

Their death appears to represent a dedicatory offering, most likely made to bless the construction of the building itself.

In comparison to other Prehispanic Peruvian sites, Marcahuamachuco and Cerro Amaru are unique in the diversity of burial customs employed by their ancient inhabitants. Each of the different burial cusoms that were practiced at these two sites would have been available contemporaneously, giving the Ancient Peruvians several different choices in regards to how to bury their dead. In contrast, other ancient Peruvian sites appear to have had a singular burial custom, i.e. wall burials around the perimeter of Kuelap (Muscutt 1998) or burial towers around the city of Puno (Isbell 1997). Therefore, the complexity of the burial customs found at Marcahuamachuco and Cerro Amaru probably reflect the complexity of the culture that inhabited the two sites.

CHAPTER 6: CONCLUSION

Marcahuamachuco, located at an elevation of 3700 meters above sea level, was a site of ancestor worship that was inhabited from approximately AD 400 to 1460. Cerro Amaru, located just south of Marcahuamachuco, was a ceremonial centre, which flourished between AD 300 and 650. Excavated in the 1980s, the skeletal elements were taken from three different burial contexts: (1) multiple internments built into the walls of niched galleries at Marcahuamachuco; (2) a sacrifice of an adult and fetus under the circular Marcahuamachuco Castillo; and (3) multiple interments housed in a mausoleum at Cerro Amaru.

Issues of preservation, excavation bias, sampling, fragmentation and co-mingling all played a role in the analyses of the skeletal remains, making it highly probable that a lot more individuals may have been represented by the skeletal elements analyzed. Several males and females were interred in wall burials and the mausoleum, compared to a single adult female and fetus buried underneath the Castillo.

With the exception of fetal remains, all age categories were represented in the skeletal assemblages from the burials inside the wall niches and the mausoleum. However, there did appear to be fewer juvenile individuals comparable to adults. Therefore, places of ancestral worship and mourning (the mausoleum and the galleries) were not saved for a particular age or sex. The only fetal remains that were observed belonged to an almost full-term fetus of unknown sex who was recovered from underneath the Castillo.

Stature estimates from the wall burials fall in the normal range for both males and females comparable to other Peruvian populations. In contrast, the young adult female that was recovered from underneath the Castillo appeared to be taller than most other highland Peruvian female populations. Therefore, it is possible that the female individual may have migrated from a different coastal population and/or that she was chosen for this important offering because she was so tall. Isotopic analyses could confirm or refute this supposition

Overall, the entire skeletal collection from Marcahuamachuco and Cerro Amaru appears healthy. With the few exceptions of cribra orbitalia and porotic hyperostosis, there do not appear to be any indications of skeletal stress on the remains. The only pathological conditions that were prevalent were dental caries and antemortem tooth loss. These lesions were likely caused by a carbohydrate rich diet and/or coca use to combat high altitude sickness.

In the skeletal sample from the niched halls, there were several incidents of antemortem trauma in young adult males. Therefore, even though Marcahuamachuco is believed to have been a ceremonial centre, there were examples of violence, even if they were isolated incidents. A calvarium recovered from inside the mausoleum also showed evidence of a violent attack. On the occipital of ID 208, a blunt force trauma injury had several fractures radiating from the point of impact. There does not appear to be any signs of the healing. This injury was likely the individual's cause of death.

Particular attention was paid to intentional human modification of bone, as it could potentially be directly correlated to ancient cultural and ritualistic burial practices. Several individuals buried within the walls of the gallery displayed what appeared to be cord indentations on the midshaft of their femur and tibia. These indentations are consistent with mortuary treatment practices illustrated on mummified remains from the Huamachuco area, and other highland sites. The bone modifications were possibly the result of wrapping and tightening a cord around the legs of the deceased individual, so that they could be buried in a flexed and seated position.

Skeletal remains from the young adult female buried under the Castillo, revealed incised cut marks and chop marks on bones of the joints. These marks are consistent with intentional dismemberment. An offering of highly valuable turquoise and Spondylus shell were found directly above the grave. The two victims, mother and unborn child, were laid to rest along with at least eighteen young articulated domesticated camelids. Due to the valuable grave offerings, in conjunction with the violent dismemberment, the young pregnant adult female is believed to have been an offering made during the building of the Castillo. It is not clear if she was sacrificed or not, but the context does suggest that is highly probable. Dismemberment and sacrifice, practices illustrated in both Peruvian iconography and the archaeological record, were previously unrecorded at the north highland sites of Marcahuamachuco and Cerro Amaru.

Cut marks were also found on several long bone fragments recovered from inside the mausoleum. The cut marks on the lower long bones appear random and/or focused around the large muscle attachment sites. These locations are consistent with intentional defleshing. Even with the extensive fragmentation and water damage, there is sufficient data to presume that the skeletal remains were not from sacrificial or dismembered individuals.

Overall, the sites of Marcahuamachuco and Cerro Amaru provided a rich diversity of burial customs and rituals. Each of the four burial contexts are unique comparable to each other. Each burial context has a different demographic profile, i.e. some contain males and females of average height ranging in age from juvenile to older adult, while another contains an exceptional tall and robust young woman. Each burial location also has distinctive mortuary architecture. Finally, each different burial custom had a different form of post-mortem alteration of bone, including cut marks.

From this analysis several aspects of future research have been identified. First and foremost, a complete analysis of all the skeletal material recovered from Marcahuamachuco and Cerro Amaru should be undertaken. Currently only about one third of all the skeletal material has been examined and analyzed. Second, the pattern and treatment of fetuses at Andean sites is currently unknown. Due to high mortality rates in Pre-Columbian Peru, it can be assumed that there were fetuses dying; however, their remains have yet to be discovered. Third, more cut mark analyses should be conducted at other highland sites, especially when secondary burials have been observed, i.e. Kuelap and Laguna de los Condors. This will help in determining whether the intentional post-mortem alteration patterns observed at Marcahuamachuco and Cerro Amaru are unique to the highlands.

Recommendations for further studies of burial ritual and sacrifice in the Andes, and elsewhere, include: (1) every archaeological team should include a biological anthropologist, as they can help provide vital information about burial contexts and rituals; (2) More attention should be paid to human remains when they are *in situ.* This includes recording the burial position, describing in detail the position of the skeleton and associated cultural material, making drawings of the grave, and recording the entire scene with photographs; (3) Data pertaining to quality/quantity of grave goods, trauma, and biological observations such as age, sex and health should accompany any description of the burial, as they add vital information about the context of the burial.

Even though the skeletal remains recovered from the sites of Marcahuamachuco and Cerro Amaru is highly fragmentary, commingled and badly weathered, they still provided a lot of valuable information about the two sites. There are still a lot of bones that need to be analyzed from the original excavations in the 1980s. Similarly, the bones that were analyzed for this study still potentially have a great deal of more information to reveal. However, even with the small sample of skeletal material analyzed, the bones illuminated the diversity of mortuary customs and burial practices that occurred in such a spatially confined area.

REFERENCES

Abe Y, Marean CW, Nilssen PJ, Assefa A and Stone EC. 2002. The Analysis of Cutmarks on Archaeofauna: A Review and Critique of Quantification Procedures, and a New Image-Analysis GIS Approach. American Antiquity 67(4):643-663.

Acsádi G and Nemeskéri J. 1970. History of Human Life Span and Mortality. Balás K, translator. Budapest: Akadémiai Kiadó.

Adams BJ and Konigsberg LW. 2004. Estimation of the Most Likely Number of Individuals from Commingled Human Skeletal Remains. American Journal of Physical Anthropology 125:138-151.

Allen WH, Merbs CF and Birkby WH. 1985. Evidence for Prehistoric Scaling at Nuvakwewtaqa (Chavez Pass) and Grasshopper Ruin, Arizona. In: Merbs CF and Miller RJ, editors. Health and Disease in the Prehistoric Southwest. Arizona State University Anthropological Research Paper No. 34. Tempe: Arizona State University, pp. 23-42.

Alva W and Donnan CB. 1993. Royal Tombs of Sipán. Los Angeles: Fowler Museum of Cultural History.

Andrushko VA, Grady DL, Latham KA and Pastron A. 2000. Cutmarks and Drill Holes: A Study of the Cultural Modification of Human Remains from Central California. American Journal of Physical Anthropology 30(Supplement):97.

Aufderheide AC. 1996. Secondary Applications of Bioanthropological Studies on South American Andean Mummies. In: Spindler K, Wilfing H, Rastbichler-Zissernig E, zur Neddon D and Nothdurfter H, editors. The man in the Ice, Volume 3. New York: Springer-Verlag, pp. 141-151.

Bass WM. 1995. Human Osteology: A Laboratory and Field Manual. Missouri: Missouri Archaeological Society.

Benson EP. 2001. Why Sacrifice? In: Benson EP and Cook AG, editors. Ritual Sacrifice in Ancient Peru. Austin: University of Texas Press, pp. 1-20.

Binford LR. 1981. Bones: Ancient Men and Modern Myths. New York: Academic Press.

Black III TK. 1978. A New Method for Assessing the Sex of Fragmentary Skeletal Remains: Femoral Shaft Circumference. American Journal of Physical Anthropology 48:227-232.

Blakely RL and Matthews DS. 1990. Bioarchaeological evidence for a Spanish-Native American Conflict in the Sixteenth-Century Southeast. American Antiquity 55(4):718-744.

Blom DE. 1998. Tiwanaku Regional Interaction and Social Identity: A Bioarchaeological Approach. Doctoral Thesis: University of Chicago.

Blom DR, Janusek JW and Buikstra JE. 2003. A Re-evaluation of Human Remains from Tiwanaku. In: Kolata AL. Tiwanaku and its Hinterland: Archaeology and Paleoecology of an Andean Civilization, Volume 2, Urban and Rural Archaeology. Washington, DC: Smithsonian Institution Press, pp. 435-446.

Bonnichsen R. 1989. An Introduction to Taphonomy with an Archaeological Focus. In: Sorg MH and Bonnichsen R, editors. Bone Modification. Center for the Study of the First Americans. Orono: University of Maine, pp. 1-6.

Bonte W. 1975. Tool Marks in Bones and Cartilage. Journal of Forensic Sciences 20(2):315-324.

Bourget S. 2001a. Children and Ancestors: Ritual Practices at the Moche Site of Huaca de la Luna, North Coast of Peru. In: Benson EP and Cook AG, editors. Ritual Sacrifice in Ancient Peru. Austin: University of Texas Press, pp. 93-118.

Bourget S. 2001b. Rituals of Sacrifice: It's Practice at Huaca de la Luna and Its Representation in Moche Iconography. In: Pillsbury J, editor. Moche Art and Archaeology in Ancient Peru. Washington: National Gallery of Art, Washington.

Bridges PS. 1996. Warfare and Mortality at Kroger's Island, Alabama. International Journal of Osteoarchaeology 6:66-75.

Bromage TG and Boyde A. 1984. Microscopic Criteria fro the Determinations of Directionality of Cutmarks on Bone. American Journal of Physical Anthropology 65:359-366.

Brooks S and Suchey JM. 1990. Skeletal Age Determination Based on the Os Pubis: A Comparison of the Acsádi-Nemeskéri and Suchey-Brooks Methods. Human Evolution 5(3):227-238.

Browne DM, Silverman, H and Garcia R. 1993. A Cache of 48 Nasca Trophy Heads from Cerro Carapo, Peru. Latin American Antiquity 4(3):274-294.

Bueschgen WD and Case DT. 1996. Evidence of Prehistoric Scalping at Vosberg, Central Arizona. International Journal of Osteoarchaeology 6:230-248.

Buikstra JE and Mielke JH. 1985. Demography, Diet and Health. In: Gilbert RI and Mielke JH, editors. The Analysis of Prehistoric Diets. New York: Academic Press, pp. 359-422.

Buikstra JE and Ubelaker DH, editors. 1994. Standards for Data Collection from Human Skeletal Remains. Arkansas Archaeological Survey Research Series: 44.

Burger RL. 1984. The Prehistoric Occupation of Chavín de Huántar, Peru. Berkeley: University of California Press.

Burger RL. 1992. Chavin and the Origins of Andean Civilization. London: Thames and Hudson.

Byers SN. 2002. Introduction to Forensic Anthropology. Toronto: Allyn and Bacon.
Ceruti MC. 2003. Elegidos de los Dioses: Identidad y Estatus en las Victimas Sacrificiales del Volcan Lluillaillaco. Boletin de Arqueologia PUCP 7:263-276.

Childe VG. 1951. Man Makes Himself (Rev. Ed.). New York: New American Library.

Childe VG. 1957. What Happened in History. Baltimore: Pelican Books.

Cobo B. 1990 [1653]. Historia de Nuevo Mundo, Lib IV. Madrid: Biblioteca de Autores Españoles.

Conrad GW. 1982. The Burial Platforms of Chan Chan: Some Social and Political Implications. In: Moseley ME and Day KC. Chan Chan: Andean Desert City. A School of American Research Book. Albuquerque: University of New Mexico Press, pp. 87-117.

Cook AG. 2001. Huari D-Shaped Structures, Sacrificial Offerings, and Divine Rulership. In: Benson EP and Cook AG, editors. Ritual Sacrifice in Ancient Peru. Austin: University of Texas Press, pp. 137-164.

Cordy-Collins A. 2001. Blood and the Moon Priestesses: *Spondylus* Shells in Moche Ceremony. In: Benson EP and Cook AG, editors. Ritual Sacrifice in Ancient Peru. Austin: University of Texas Press, pp. 35-54.

Cybulski JS. 1978. Modified Human Bones and Skulls from Prince Rupert Harbour, British Columbia. Canadian Journal of Archaeology 2:15-32.

Darling JA. 1998. Mass Inhumation and the Execution of Witches in the American Southwest. American Anthropologist 100(2):732-752.

del Angel A and Cisneros HB. Technical Note: Modification of Regression Equations Used to Estimate Stature in Mesoamerican Skeletal Remains. American Journal of Physical Anthropology 125:264-265.

Degusta D. 2000. Fijian Cannibalism and Mortuary Ritual: Bioarchaeological Evidence from Vunda. International Journal of Osteoarchaeology 10:76-92.

DeLeonardis L. 2000. The Body Context: Interpreting Early Nasca Decapitated Burials. Latin American Antiquity 11(4):363-386.

Dillehay TD, Bonavia D, and Kaulicke P. 2004. First Settlers. In: Silverman H, editor. Andean Archaeology. Oxford: Blackwell Publishing, pp. 16-34.

Dixon KA. 1959. Two Carved Human Bones from Chiapas. Archaeology 12(1):106-110.

Doig KF. 1966. Mochica-Nazca-Recuay en la Arqueologia Peruana. Lima: Universidad Nacional Mayor de San Marcos.

Donnan RD. 1995. Moche Funerary Practice. In: Dillehay TD, editor. Tombs for the Living: Andean Mortuary Practices. Washington, DC: Dumbarton Oaks Research Library and Collection, pp. 111-160.

Donnan, C.B. 1997. Introduction. In: Donnan CB and Cock G, editors. Pacatnamú Papers, Volume 2. Los Angeles: University of California, Museum of Cultural History, pp. 9-16.

Donnan CB and McClelland D. 1979. The Burial Theme in Moche Iconography. Studies in Pre-Columbian Art & Archaeology, Number Twenty-one. Washington, DC Trustees for Harvard Research.

Donnan CB and McClelland D. 1997. Moche Burials at Pacatnamú. In: Donnan CB and Cock G, editors. Pacatnamú Papers, Volume 2. Los Angeles: University of California, Museum of Cultural History, pp. 189-215.

Drusini AG and Baraybar JP. 1991. Anthropological Study of Nasca Trophy Heads 41(3):251-265.

Dudar JC, Pfeiffer S, Saunders SR. 1993. Evaluation of Morphological and Histological Adult Skeletal Age-At-Death Estimation Techniques using Ribs. Journal of Forensic Sciences 38:677-685.

During EM and Nilsson L. 1991. Mechanical Surface Analysis of Bone: A Case Study of Cut Marks and Enamel Hypoplasia on a Neolithic Cranium from Sweden. American Journal of Physical Anthropology 84:113-125.

Eaton GF. 1916. The Collection of Osteological Material from Machu Picchu. New Haven, Connecticut: Tuttle, Morehouse and Taylor.

Eeckhout P and Owens LS. 2008. Human Sacrifice at Pachacamac. Latin American Antiquity 19(4): 375-398.

Efremov LA. 1940. Taphonomy: A New Branch of Paleontology. Pan-American Geologist 74:81-93.

El-Najjar MY and Mc Williams KR. 1978. Forensics Anthropology. Springfield: Charles C. Thomas.

Eveleth PB and Tanner JM. 1990. Worldwide Variation in Human Growth. Cambridge: Cambridge University Press.

Faerman M, Bar-Gal GK, Filon D, Greenblatt CL, Stager L, Oppenheim A, and Smith P. 1998. Determining the Sex of Infanticide Victims from the Late Roman Era through Ancient DNA Analysis. Journal of Archaeological Science 25:861-865.

Faerman M, Kahila G, Smith P, Greenblatt C, Stager L, Filon D, and Oppenheim A. 1997. DNA Analysis Reveals the Sex of Infanticide Victims. Nature 385:212-213.

Farnum JF. 2002. Biological Consequences of Social Inequalities in Prehistoric Peru. Doctoral Thesis: University of Missouri

Feagins JD. 1989. Prehistoric Treatment of Human Skull from Northwest Missouri. Missouri Archaeology Society Quarterly 6(2):4-5.

Fernández-Jalvo Y, Díez JC, Cáceres I and Rosell J. 1999. Human Cannibalism in the Early Pleistocene of Europe (Gran Dolina, Sierra de Atapuerca, Burgos, Spain). Journal of Human Evolution 37:591-622.

Fieller NRJ and Turner A. 1982. Number Estimation in Vertebrate Samples. Journal of Archaeological Science 9:42-62.

Flannery KV. 1967. Vertebrate Fauna and Hunting Patterns. In: Byers DS, editor. The Prehistory of the Tehuacan Valley, Volume 1: Environment and Subsistence. Austin, Texas: University of Texas Press.

Floinn RO. 1995. Recent Research into Irish Bog Bodies. In: Turner RC and Scaife RG, editors. Bog Bodies: New Discoveries and New Perspectives. London: British Museum Press, pp. 137-145.

Frame M. 2001. Blood, Fertility, and Transformation: Interwoven Themse in the Paracas Necropolis Embroideries. In: Benson EP and Cook AG. Ritual Sacrifice in Ancient Peru. Austin, Texas: University of Texas Press, pp. 55-92.

Frayer DW. 1997. Ofnet: Evidence for a Mesolithic Massacre. In: Martin DL and Frayer DW. Troubled Times: Violence and Warfare in the Past. Amsterdam: Gordon and Breach, pp. 181-216.

Frisancho AR, Garn SM, Ascoli W. 1970. Subperiosteal and Endosteal Bone Apposition During Adolescence. Human Biology 42:639-664.

Gálvez MC and Briceño JR. 2001 The Moche in the Chicama Valley. In: Pillsbury J, editor. Moche Art and Architecture. Studies in History of Art No. 63. Center for

Advanced Study in the Visual Arts, National Gallery of Art, Washington. New Haven: Yale University Press.

Garland AN. 1995. Worsley Man, England. In: Turner RC and Scaife RG, editors. Bog Bodies: New Discoveries and New Perspectives. London: British Museum Press.

Garn SM. 1970. The Earlier Gain and the Later Loss of Cortical Bone. Springfield, Ill: Charles C. Thomas.

Genovés S. 1967. Proportionality of the Long Bones and their Relation to Stature among Mesoamericans. American Journal of Physical Anthropology 26:67-47.

Giles E and Elliot O. 1963. Sex Determination by Discriminant Function Analysis of Crania. American Journal of Physical Anthropology 21:53-68.

Girard R. 1977. Violence and the Sacred. Baltimore: Johns Hopkins University Press.

González-Reimers E, Velasco-Vázquez J, Arnay-de-la-Rosa M and Santolaria-Fernández F. 2000. Sex Determination by Discriminant Function Analysis of the Right Tibia in the Prehispanic Population of the Canary Islands. Forensic Science International 108: 165-172

Götherström A, Lidén K, Ahlström T, Källersjö M, and Brown TA. 1997. Osteology, DNA and Sex Identification: Morphological and Molecular Sex Identifications of Five Neolithic Individuals from Ajvide, Gotland. International Journal of Osteoarchaeology 7:71-81.

Graver S, Sobolik KD, Whittaker J. 2002. Cannibalism or Violent Death Alone? Human Remains at a Small Anasazi Site. In: Haglund WD and Sorg MH. Advances in Forensic Taphonomy: Method, Theory, and Archaeological Perspectives. New York: CRC Press, pp. 309-320.

Green MA. 1999. Human Sacrifice in Iron Age Europe. Discovering Archaeology 1(2):56-65.

Greenfield HJ. 2002. Distinguishing Metal (Steel and Low-tin Bronze) from Stone (Flint and Obsidian) Tool Cut Marks on Bone: An Experimental Approach. In: Mathieu JR, editor. Experimental Archaeology: Replicating Past Objects, Behaviour and Processes. BAR International Series 1035. Oxford: Archeopress, pp. 35-54.

Guerts MA. 1982. Observations Geomorphologiques dans la Region de Huamachuco, Andes Centrales Peruviennes: Research Notes. Department of Geography, Ottawa: University of Ottawa.

Guillén SE. 1992. The Chinchorro Culture: Mummies and Crania in the Reconstruction of Preceramic Coastal Adaptation in the South Central Andes. Doctoral Thesis: University of Michigan.

Guillén SE, Nelson A, Conlogue G, Beckett R, Sosa J and Topic J. 2009. Three New Mummies from Huamachuco, Peru: A New Location for the Pattern of Mummification Demonstrated at Laguna de los Condores, Peru. Paper Presented to the 1st Annual Bolzano Mummy Congress.

Haas J and Creamer W. 1993. Stress and Warfare Among the Kayenta Anasazi of the Thirteenth Century AD. Fieldiana Anthropology, New Series No. 21. Chicago: Field Museum of Natural History.

Haglund WD and Sorg MH. 1997. Method and Theory of Forensic Taphonomic Research. In: Haglund WD and Sorg MH. Forensic Taphonomy: The Postmortem Fate of Human Remains.Boca Raton, Florida: CRC Press, pp.13-26.

Haglund and Sorg. 2002. Advancing Forensic Taphonomy: Purpose, Theory and Process. In: Haglund WD and Sorg MH. Advances in Forensic Taphonomy: Method, Theory, and Archaeological Perspectives. New York: CRC Press, pp. 3-29.

Hamilton LA. 2005. Cut Marks as Evidence of Precolumbian Human Sacrifice and Postmortem Bone Modification on the North Coast of Peru. Doctoral Thesis: Tulane University.

Harman M, Molleson TI and Price JL. 1981. Burials, Bodies and Beheadings in Romano-British and Anglo-Saxon Cemeteries. Bulletin of the British Museum (Natural History) 35(3):145-188.

Hauser G and De Stefano GF. 1989. Epigenetic Variants of the Human Skull. Germany: Schweizerbart Stuttgart.

Haverkort Cm and Lubell D. 1999.Cutmarks on Capsian Human Remains: Implications for Maghreb Holocene Social Organization and Palaeoeconomy. International Journal of Osteoarchaeology 9:147-169.

Hershkovitz I, Latimer B, Dutour O, Jellema, LM, Wish-Baratz S, Rothschild C and Rothschild BM. 1997. Why Do We Fail in Aging the Skull from the Sagittal Suture? American Journal of Physical Anthropology 103:393-399.

Hester TR. 1969. Human Bone Artifacts from Southern Texas. American Antiquity 34(3):326-328.

Heyerdahl T, Sandwiess DH and Narváez A. 1995. Pyramids of Túcume. New York: Thames and Hudson.

Hirshhorn JN, Lindgren CM, Daly MJ, Kirby A, Schaffner SF, Burtt NP, Altshuler D, Parker A, Rioux JD, Platko J, Gaudet D, Huson TJ, Groop LC, and Lander ES. 2001. Genomewide Linkage Analysis of Stature in Multiple Populations Reveals Several Regions with Evidence of Linkage to Adult Height. American Journal of Human Genetics 69:106-116.

Hogue SH. 2006. Determination of Warfare and Interpersonal Conflict in the Protohisotric Period: A Case Study from Mississippi. International Journal of Osteoarchaeology 16:236-248.

Holland TD. 1986. Sex Determination of Fragmentary Crania Analysis of the Cranial Base. American Journal of Physical Anthropology 70:203-208.

Holliman SE and Owsley DW. 1994. Osteology of the Ray Tolton Site: Implications for Warfare during the Initial Middle Missouri Variant. In: Owsley DW and Jantz RL. Skeletal Biology in the Great Plains. Washington D.C.: Smithsonian Institution Press, pp. 345-353.

Holman DJ and Bennet KA. 1991. Determination of Sex from Arm Bone Measurements. American Journal of Physical Anthropology 84:421-426.

Houck MM. 1998. Skeletal Trauma and the Individualization of Knife Marks in Bone. In: Reichs K. Forensic Osteology: Advances in the Identification of Human Remains, Second Edition. Springfield, Illinois: Charles C Thomas, pp. 410-424.

Hoyme LE and Bass WM. 1962. Human Skeletal Remains from the Tollifero (Ha6) and Clarksville (Mc14) Sites, John H. Kerr Reservoir Basin, Virginia. Bureau of American Ethnology Bulletin 182:329-400.

Hrdlicka A. 1914. Anthropological Work in Peru in 1913, With Notes on the Pathology of the Ancient Peruvians. Smithsonian Miscellaneous Collections, Volume 61(18). Washington: Smithsonian Institute.

Hrdlicka A. 1938. The Femur of the Old Peruvians. American Journal of Physical Anthropology 23(4):421-462.

Hurlbut SA. 2000. The Taphonomy of Cannibalism: A Review of Anthropogenic Bone Modification in the American Southwest. International Journal of Osteoarchaeology 10:4-26.

Hutchinson DL. 1996. Brief Encounters: Tatham Mound and the Evidence for Spanish and Native American Confrontation. International Journal of Osteoarchaeology 6:51-65.

Indriati E and Buikstra JE. 2001. Coca Chewing in Prehistoric Coastal Peru: Dental Evidence. American Journal of Physical Anthropology 114:242-257.

Isbell WH. 1997. Mummies and Mortuary Monuments: A Postprocessual Prehistory of Central Andean Social Organization. Austin: University of Texas Press.

Isbell WH, Brewster-Wray C, and Spickard L. 1991. Architecture and Spatial Organziation at Huari. In: Isbell WH, McEwan GF, editors. Hauri Administrative Structure: Prehistoric Monumental Architecture and State Government. Washington, DC: Dumbarton Oaks Research Library and Collection, pp. 19-53.

Isçan MY and Loth SR. 1986a. Determination of Age from the Sternal Rib in White Females: A Test of the Phase Method. Journal of Forensic Sciences 31:990-999.

Isçan MY and Loth SR. 1986b. Determination of Age from the Sternal Rib in White Males: A Test of the Phase Method. Journal of Forensic Sciences 31:122-132.

Isçan MY, Loth SR and Scheuerman EH. 1989. Assessment of Intercostal Variation on the Estimation of Age from the Sternal End of the Rib. American Journal of Physical Anthropology 78:245 (Abstract).

Isçan MY, Loth SR and Wright RK. 1984a. Age Estimation from the Rib by Phase Analysis: White Males. Journal of Forensic Sciences. 29:1094-2104.

Isçan MY, Loth SR and Wright RK. 1984b. Metamorphosis at the Sternal Rib End: A New Method to Estimate Age at Death in White Males. American Journal of Physical Anthropology 65:147-156.

Isçan MY, Loth SR and Wright RK. 1985. Age Estimation from the Rib Phase Analysis: White Females. Journal of Forensic Sciences 30:853-863.

Isçan MY and Miller-Shaivitz P. 1984. Determination of Sex from the Tibia. American Journal of Physical Anthropology 64:53-57.

Ishida H and Dodo Y. 1997. Cranial Variation in Prehistoric Human Skeletal Remains from the Marianas. American Journal of Physical Anthropology 104:399-410.

Jamieson JB. 1983. An Examination of Prisoner-Sacrifice and Cannibalism at the St. Lawrence Iroquoian Roebuck Site. Canadian Journal of Archaeology 7(2):159-175.

Jelínek J. 1993. Dismembering, Filleting and Evisceration of Human Bodies in a Bronze Age Site in Moravia, Czech Republic. Anthropologie (Brno) 30:99-114.

Kantner J. 1999. Anasazi Mutilation and Cannibalism in the American Southwest. In: Goldman LR, editor. The Anthropology of Cannibalism. London: Bergin and Garvey, pp. 75-104.

Kellner C. 2002. Coping with Environmental and Social Challenges in Prehistoric Peru: Bioarchaeological Analyses of Nasca Populations. Doctoral Thesis: University of California, Santa Barbara.

Kembel SR and Rick JW. 2004. Building Authority at Chavín de Huántar: Models of Social Organization and Development in the Initial Period and Early Horizon. In: Silverman H, editor. Andean Archaeology. Oxford: Blackwell Publishing, pp. 51-76.

Kemkes-Grottenthaler A. 2005. The Short Die Young: The Interrelationship Between Stature and Longevity – Evidence from Skeletal Remains. American Journal of Physical Anthropology 128:340-347

Kolata AL. 1993. The Tiwanaku: A Portrait of an Andean Civilization. Oxford: Blackwell Publishing.

Konigsberg LW. 1987. Population Genetic Models for Interpreting Prehistoric Intra-cemetery Biological Variation. Doctoral Thesis: Northwestern University.

Konigsberg LW. 1988. Migration Models of Prehistoric Postmarital Residence. American Journal of Physical Anthropology 77:471-482.

Krogman WM and Işcan MY. 1986. The Human Skeleton in Forensic Medicine. Springfield: Charles C. Thomas.

Lahr MM. 1996. The Evolution of Modern Human Diversity: A Study of Cranial Variation. Cambridge: Cambridge University Press.

Lambert PM, Billman BR and Leonard BL. 2000. Explaining Variability in Mutilated Human Bone Assemblages from the American Southwest: A Case Study from the Southern Piedmont of Sleeping Ute Mountain, Colorado. International Journal of Osteoarchaeology 10:49-64.

Larsen CL. 1997. Bioarchaeology: Interpreting Behaviour from the Human Skeleton. Cambridge: Cambridge University Press.

Lau GF. 2002. Feasting and Ancestor Veneration at Chinchawas, North Highlands of Ancash, Peru. Latin American Antiquity 13(3):279-304.

Liston MA and Baker BJ. 1996. Reconstructing the Massacre at Fort William Henry, New York. International Journal of Osteoarchaeology 6:28-41.

Loten HS. 1987. Burial Tower 2 and For A, Marcahuamachuco. Peterborough, Ontario: Trent University Occasional Papers in Anthropology No. 3.

Loth SR. 1995. Age Assessment of the Spitalfields Cemetery Population by Rib Phase Analysis. American Journal of Human Biology 7:465-471.

Loth SR and Isçan MY. 1994. Morphological Indicators of Skeletal Aging: Implications for Paleodemography and Paleogerontology. In: Crews DE and Garruto RM, editors. Biological Anthropology and Aging: Perspectives on Human Variation Over the Life Span. New York: Oxford University Press, pp, 394-425.

Loth SR and Isçan MY. 1995. From Neandertals to Contemporary Man: An Overview of Age Assessment from the Rib. Riv. Antropol. 73:11-20.

Lovejoy CO. 1985. Dental Wear in the Libben Population: Its Functional Pattern and Role in the Determination of Adult Skeletal Age at Death. American Journal of Physical Anthropology 68:47-56.

Luff R. 1996. The 'Bare Bones' of Identifying Ritual Behaviour in the Archaeological Record. In: Anderson S and Boyle K, editors. Ritual Treatment of Human and Animal Remains. Proceedings of the First Meeting of the Osteoarchaeological Research Group held in Cambridge on 8th October 1994. Oxford: Oxbow Books.

Lynnerup N and Jacobsen JCB. 2003. Brief Communication: Age and Fractal Dimensions of Human Sagittal and Coronal Sutures. American Journal of Physical Anthropology 121:332-336.

MacCurdy GG. 1923. Human Skeletal Remains from the Highlands of Peru. American Journal of Physical Anthropology 6(3):217-329.

Mannuci A, Sullivan K, Ivanov P. 1994. Forensic Application of a Rapid Quantitative DNA Sex Test by Amplification of the X-Y Homologous Gene Amelogenin. International Journal of Legal Medicine 106:190-193.

Marques C, Matos V and Cunha E. 2000. The Skeletal Remains from a Great Medieval Portuguese Battle. American Journal of Physical Anthropology 30(Supplement):220.

Masset C. 1989. Age Estimation on the Basis of Cranial Sutures. In: Işcan MY, editor. Age Markers in the Human Skeleton. Springfield, Illinois: Charles C Thomas, pp. 77-103.

McCown T. 1945. Pre-Incaic Huamachuco: Survey and Excavations in the Region of Huamachuco and Cajabamba. University of California Publications in American Archaeology and Ethnology Volume 39:4. Berkeley.

McEwan GF. 1998. The function of Niched Halls in Wari Architecture. Latin American Antiquity 9(1):68-86.

McKinley JI. 1993. A Decapitation from the Romano-British Cemetery at Baldock, Hertfordshire. International Journal of Osteoarchaeology 3:41-44.

Means PA. 1964. Ancient Civilizations of the Andes. New York: Gordian Press, Inc.

Meindl RS, Lovejoy CO, Mensforth RM and Barton TJ. 1985. Multifactorial Determination of Skeletal Age at Death: A Method of Blind Test of its Accuracy. American Journal of Physical Anthropology 68(1):1-14.

Meindl RS, Lovejoy CO, Mensforth RM and Carlos ID. 1985. Accuracy and Direction of Error in Sexing of the Skeleton: Implications for Palaeodmography. American Journal of Physical Anthropology 68(1):79-85.

Meindl RS, Lovejoy CO, Mensforth RM and Walker PL. 1985. A Revised Method of Age Determination Using the Os Pubis, with a Review and Tests of Accuracy of Other Current Methods of Pubic Symphyseal Aging. American Journal of Physical Anthropology 68(1):29-45.

Melbye J and Fairgrieve SI. 1990. Appendix IV: The Human Remains. In: Arnold CD. Archaeological Investigations at Saunaktuk. Prince of Wales Northern Heritage Centre, Department of Culture and Communications, Government of the Northwest Territories, Yellowknife, pp. 85-113.

Melbye J and Fairgrieve SI. 1994. A Massacre and Possible Cannibalism in the Canadian Arctic: New Evidence from the Saunaktuk Site (NfTn-1). Arctic Archaeology 31(2):57-77.

Milner G, Anderson E and Smith VG. 1991. Warfare in Late Prehistoric West-Central Illinois. American Antiquity 56(4):581-603.

Milner G, Wood J and Boldsen J. 2000. Paleodemography. In: Katzenberg MA, and Saunders SR, editors. Biological Anthropology of the Human Skeleton. New York: Wiley-Liss, Inc, pp. 467-497.

Molleson T. 1991. Cuts on Human Bones Produced by Metal Implements. Anthropologie (Brno) 29(3):199-204.

Molto JE Spence MW and Fox WA. 1986. The Van Oordt Site: A Case Study in Salvage Osteology. Canadian Review of Physical Anthropology 5:49-61.

Moore-Jansen PM, Owsley SD and Jantz RL. 1994. Data Collection Procedures for Forensic Skeletal Material. Report of Investigations NO. 48. Department of Anthropology, University of Tennessee, Knoxville.

Morris I. 1991 The Archaeology of Ancestors: The Saxe-Goldstein Hypothesis Revisited. Cambridge Archaeological Journal 1: 147-169.

Morris C and Von Hagen A. 1993. The Inka Empire and its Andean Origins. New York: Abbeville Press Publishers.

Moseley ME. 1975. The Maritime Foundations of Andean Civilization. Menlo Park, CA: Cummings Publishing Company.

Moseley ME. 2001. The Incas and Their Ancestors: The Archaeology of Peru, Revised Edition. New York: Thames and Hudson.

Murphy MS. 2004. From Bare Bones to Mummified: Understanding Health and Disease in an Inca Community. Doctoral Thesis: University of Pennsylvania

Muscutt K. 1998. Warriors of the Clouds: A Lost Civilization in the Upper Amazon of Peru. Albuquerque: University of New Mexico Press.

Nelson AJ. 1998. Wandering Bones: Archaeology, Forensic Science and Moche Burial Practices. International Journal of Osteoarchaeology 8:192-212.

Nystrom KC. 2007. Trepanation in the Chachapoya Region of Northern Peru. International Journal of Osteoarchaeology 17:39-51.

Ogilvie MD and Hilton CE. 2000. Ritualized Violence in the Prehistoric American Southwest. International Journal of Osteoarchaeology 10:27-48.

Olsen SL. 1988. The Identification of Stone and Metal Tool Marks on Bone Artifacts. In: Olsen SL, editor. Scanning Electron Microscopy in Archaeology. BAR International Series 452. Oxford: British Archaeological Report, pp. 337-360

Olsen SL and Shipman P. 1988. Surface Modification on Bone: Trampling versus Butchery. Journal of Archaeological Science 15:535-553.

Olsen SL and Shipman P. 1994. Cutmarks and Perimortem Treatment of Skeletal Remains on the Northern Plains. In: Owsley DW and Jantz RL, editors. Skeletal Biology in the Great Plains. Washington, DC: Smithsonian Institution Press.

Ortner DJ. 2003. Identification of Pathological Conditions in Human Skeletal Remains. Second Edition. New York: Elsevier Science.

Owsley DW. 1984. Human Bones from Archaeological Context: An Important source of Information. Museum Anthropology 8(2):2-8.

Owsley DW. 1994. Warfare in Coalescent Tradition Populations of the Northern Plains. In: Owsley DW and Jantz RL. Skeletal Biology in the Great Plains. Washington D.C.: Smithsonian Institution Press, pp. 333-343.

Owsley DW and Berryman HE. 1975. Ethnographic and Archaeological Evidence of Scalping in the Southeastern United States. Tennessee Archaeologist 31(1):41-58.

Owsley DW, Berryman HE and Bass WM. 1977. Demographic and Osteological Evidence for Warfare at the Larson Site, South Dakota. Plains Anthropologist Memoir 13:119-131.

Owsley DW, Mann RW and Baugh TG. 1994. Culturally Modified Human Bones from the Edwards I Site. In: Owsley DW and Jantz RL, editors. Skeletal Biology in the Great Plains. Washington, DC: Smithsonian Institution Press, pp. 363-375.

Paredes J, Quintana B and Linares M. 2000. Tumbas de la Época Wari en el Callejón de Huaylas, Ancash. Boletín de Arqueologia PUCP. 4:253-288.

Peebles CS. 1977. Biocultural Adaptation in Prehistoric America: An Archaeologist's Perspective. In: Blakely RL, editor. Biocultural adaptation in Prehistoric America. Southern Anthropological Society Proceedings, No. 11. Athens: University of Georgia Press, pp.115-130.

Pfeiffer S. 2003. Introduction to the Osteobiographical Analysis. In: Williamson RE and Pfeiffer S, editors. Bones of the Ancestors: The Archaeology and Osteobiography of the Moatfield Ossuary. Mercury Series, Archaeology Paper 163. Gatineau, Quebec: Canadian Museum of Civilization, pp. 163-170.

Pickering RB. 1985. Human Osteological Remains from Alta Vista, Zacatecas: An Analysis of the Isolated Bone. In: Foster MS and Weigand PC. The Archaeology of West and Northwest Mesoamerica. Boulder: Westview Press, pp. 289-325.

Pickering RB and Foster MS. 1994. A Survey of Prehistoric Disease and Trauma in Northwest and West Mexico. Proceedings of the Denver Museum of Natural History 3(7):1-15.

Pijoan CM and Mansilla LJ. 1997. Evidence for Human Sacrifice, Bone Modification and Cannibalism in Ancient Mexico. In: Martin DL an Frayer DW, editors. Troubled Times: Violence and Warfare in the Past. Amsterdam: Gordon and Breach, pp. 217-239.

Potts R and Shipman P. 1981. Cutmarks made by Stone Tools on Bones from Olduvai Gorge, Tanzania. Nature 291:577-580.

Proulx DA. 2001. Ritual Use of Trophy Heads in Ancient Nasca Society. In: Benson EP and Cook AG, editors. Ritual Sacrifice in Ancient Peru. Austin: University of Texas Press, pp. 119-136.

Prowse TL and Lovell NC. 1996. Concordance of Cranial and Dental Morphological Traits and Evidence for Endogamy in Ancient Egypt. American Journal of Physical Anthropology 101:237-246.

Reichs KJ. 1998. Postmortem Dismemberment: Recovery, Analysis and Interpretation. In: Reichs K. Forensic Osteology: Advances in the Identification of Human Remains, Second Edition. Springfield, Illinois: Charles C Thomas, pp. 353-388.

Reinhard J. 1997. Sharp Eyes of Science Probe the Mummies of Peru. National Geographic Magazine 191(1):37-43.

Reinhard J. 1998. Research Update: New Inca Mummies. National Geographic Magazine 194(1):128-135.

Richman EA, Michel ME, Schulter-Ellis FP and Corruccini RS. 1979. Determination of Sex by Discriminant Function Analysis of Postcranial Skeletal Measurements. Journal of Forensic Sciences 24:159-163.

Roberts C and Manchester K. 1995. The Archaeology of Disease. Second Edition. New York: Cornell University Press.

Rogers TL. 1999. A Visual Method of Determining the Sex of Skeletal Remains Using the Distal Humerus. Journal of Forensic Sciences 44(1):57-60.

Rogers AR. 2000. Analysis of Bone Counts by Maximum Likelihood. Journal of Archaeological Science 27:111–125.

Rowe JH. 1946. Inca Culture at the Time of the Spanish Conquest. In: Steward JH, editor. Handbook of South American Indians, Volume 2. Washington, D.C.: Bureau of American Ethnology, Bulletin 143, pp. 183-330.

Rowe JH. 1962. Stages and Periods in Archaeological Interpretation. Southwestern Journal of Anthropology 18(1):40-54.

Ruff CB and Hayes WC. 1983. Cross-Sectional Geometry of Pecos Pueblo Femora and Tibiae: A Biomechanical Investigation II: Sex, Age and Side Differences. American Journal of Physical Anthropology 60:383-400.

Russell MD, Shipman P and Villa P. 1985. Cutmarks: Immediate vs. Delayed Carcass Processing. American Journal of Physical Anthropology 66:223-224.

Russell K, Simpson S, Genovese J, Kinkel M, Meindl R and Lovejoy C. 1993. Independent Test of the Fourth Rib Aging Technique. American Journal of Human Biology 92:53-62.

Safont S, Malgosa A and Subirà. 2000. Sex Assessment on the Basis of Long Bone Circumference. American Journal of Physical Anthropology 113:317-328.

Samaniego L, Vergara E and Bischof H. 1985. New Evidence on Cerro Sechín, Casma Valley, Peru. In: Donnan C, editor. Early Ceremonial Architecture of the Andes. Washington, DC: Dumbarton Oaks Research Library and Collection, pp. 165-190.

Santoro CM, Standen VG, Arriaza BT and Dillehay TD. 2005. Archaic Funerary Pattern or Postdepositional Alternation? The Patapatane Burial in the Highlands of South Central Andes. Latin American Antiquity 16(3): 329-346.

Sauer NJ. 1984. Manner of Death: Skeletal Evidence of Blunt and Sharp Instrument Wounds. In: Rathburn TA and Buikstra JE. Human Identification: Case Studies in Forensic Anthropology. Springfield, Illinois: Charles C Thomas, pp. 176-184.

Sauer NJ. 1998. The Times of Injuries and Manner of Death: Distinguishing Among Antemortem, Perimortem and Postmortem Trauma. In: Reichs K. Forensic Osteology: Advances in the Identification of Human Remains, Second Edition. Springfield, Illinois: Charles C Thomas, pp. 321-332.

Sauer NJ, Dunlap SS and Simson LR. 1988. Medicolegal Investigation of an Eighteenth Century Homicide. The American Journal of Forensic Medicine and Pathology 9(1):66-73.

Saunders SR. 1992. Subadult Skeletons and Growth Related Studies. In: Saunders SR and Katzenburg MA, editors. Skeletal Biology of Past Peoples: Research Methods. New York: Wiley-Liss, pp. 1-20.

Saunders SR, Fitzgerald C, Rogers T, Dudar JC, McKillop H. 1992. A Test of Several Methods of Skeletal Age Estimation using a Documented Archaeological Sample. Canadian Society of Forensic Science 25:97-118.

Saunders SR and Hoppa RD. 1993. Growth Deficit in Survivors and Non-Survivors: Biological Mortality Bias in Subadult Skeletal Samples. Yearkbook of Physical Anthropology 36:127-152.
Scheuer L and Black S. 2000. Developmental Juvenile Osteology. New York: Elsevier Academic Press.

Schwartz JH. 1995. Skeleton Keys. Oxford: Oxford University Press.

Seed, P. 2000. Conquest of the Americas 1500 – 1650. In: Parker G, editor. The Cambridge Illustrated History of Warfare. Cambridge: Cambridge University Press.

Shaughnessy RE. 1984. High Altitude Land Use, Past and Present, in the Huamachuco Area, North Highlands, Peru. M.A. Thesis: Trent University.

Shipman P. 1981. Applications of Scanning Electron Microscopy to Taphonomic Problems. Annals of the New York Academy of Sciences 376:357-385.

Shipman 1988. Bone Tools: An Experimental Approach. In: Olsen SL, editor. Scanning Electron Microscopy in Archaeology. BAR International Series 452. Oxford: British Archaeological Reports, pp. 303-335.

Shipman P and Rose J. 1983. Early Hominid Hunting, Butchering and Carcass-Processing Behaviours: Approaches to the Fossil Record. Journal of Anthropological Archaeology 2:57-98.

Silverman H. 2004. Introduction. In: Silverman H, editor. Andean Archaeology. Oxford: Blackwell Publishing, pp. 1-15.

Smith MO. 1993. A Probable Case of Decapitation at the Late Archaic Robinson Site (40SM4), Smith County, Tennessee. Tennessee Archaeologist 18(2):131-142.

Smith MO. 1995. Scalping in the Archaic Period: Evidence from the Western Tennessee Valley. Southeastern Archaeology 14(1):60-68.

Smith MO. 1997. Osteological Indications of Warfare in the Archaic Period of the Western Tennessee Valley. In: Martin DL and Frayer DW, editors. Troubled Times: Violence and Warfare in the Past. Amsterdam: Gordon and Breach, pp. 241-265.

Start HV and Robertson DJ. 1998. Morbid Osteology: Osteological Evidence for Post Mortem Procedures from Newcastle Infirmary Burial Ground (1753-1845). American Journal of Physical Anthropology 26(Supplement):208.

Steckel RH. 1995. Stature and the Standard of Living. Journal of Economic Literature 33:1903-1940.

Steele DG. 1970. Estimation of Stature from Fragments of Long Limb Bones. In: Stewart TD, editor. Personal Identification in Mass Disasters. Washington, DC: Smithsonian Institution, pp. 85-97.

Stewart TD. 1979. Essentials of Forensic Anthropology. Springfield: Charles C. Thomas.

Steyn M and Isçan MY. 1998. Sexual Dimorphism of the Crania and Mandibles of South African Whites. Forensic Science International 98:9-16.

Stinson S. 1990. Variation in Body Size and Shape Among South American Indians. American Journal of Human Biology 2:37-51.

Sutter RC and Cortez RJ. 2005. The Nature of Moche Human Sacrifice: A Bioarchaeological Perspective. Current Anthropology 46(4):521-549.

Sutter RC and Mertz L. 2004. Nonmetric Cranial Trait Variation and Prehistoric Biocultural Change in the Azapa Valley, Chile. American Journal of Physical Anthropology 123:130-145.

Symes SA, Berryman HE, Smith OC. 1998. Say Marks in Bone: Introduction and Examination of Residual Kerf Contour. In: Reichs KJ, editor. Forensic Osteology, Advances in the Identification of Human Remains, Second Edition. Springfield: Charles C. Thomas, pp. 389-409.

Symes SA, Williams JA, Murray EA, Hoffman JM, Holland TD, Saul JM, Saul FP, and Pope EJ. 2002. Taphonomic Context of Sharp-Force Trauma in Suspected Cases of Human Mutilation and Dismemberment. In: Haglund WD and Sorg MH. Advances in Forensic Taphonomy: Method, Theory, and Archaeological Perspectives. New York: CRC Press, pp. 403-434.

Thatcher J. 1972. Continuity and Change in the Ceramics of Huamachuco, North Highlands, Peru. Doctoral Thesis: University of Pennsylvania.

Topic JR. 1991. Hauri and Huamachuco. In: Isbell WH, McEwan GF, editors. Hauri Administrative Structure: Prehistoric Monumental Architecture and State Government. Washington, DC: Dumbarton Oaks Research Library and Collection, 141-164.

Topic JR and Chiswell CE. 1992. Inka Storage in Huamachuco. In: LeVine TY, editor. Inka Storage Systems. Norman: University of Oklahoma Press.

Topic JR and Topic TL. 1982. Huamachuco Archaeological Project: Preliminary Report on the First Season, July-August 1981. Peterborough: Trent University Papers in Anthropology.

Topic JR and Topic TL. 1983a. Coast-Highland Relations in Northern Peru: Some Observations on Routes, Networks, and Scales of Interaction. In: Leventhal RM, Kolata AL, editors. Civilization in the Ancient Americas: Essays in Honor of Gordon R. Wiley. Cambridge, Massachusetts: University of New Mexico Press and Peabody Museum of Archaeology and Ethnology Harvard University, pp. 237-259.

Topic JR and Topic TL. 1983b. Huamachuco Archaeological Project: Preliminary Report on the Second Season, June-August 1982. Peterborough: Trent University Papers in Anthropology.

Topic JR and Topic TL. 1988. Huamachuco Archaeological Project: Report on the 1987 Field Season. Presented to Social Science and Humanities Research Council of Canada.

Topic JR and Topic TL. 1988. Huamachuco Archaeological Project: Report on the 1988 Field Season. Peterborough: Trent University Papers in Anthropology.

Topic JR and Topic TL. 1993. A Summary of the Inca Occupation of Huamachuco. In: Malpass MA, editor. Provincial Inca: Archaeological and Ethnohistorical Assessment of the Impact of the Inca State. Iowa City: University of Iowa Press, pp.17-43.

Topic TL. 1991. The Middle Horizon in Northern Peru. In: Isbell WH, McEwan GF, editors. Hauri Administrative Structure: Prehistoric Monumental Architecture and State Government. Washington, DC: Dumbarton Oaks Research Library and Collection, pp. 233-246.

Topic TL and Topic JR. 1984. Huamachuco Archaeological Project: Preliminary Report on the Third Season, June-August 1983. Peterborough: Trent University Occasional Papers in Anthropology No. 1.

Topic TL and Topic JR. 1987. Huamachuco Archaeological Project: Preliminary Report on the 1986 Field Season. Peterborough: Trent University Occasional Papers in Anthropology No. 4.

Topic TL and Topic JR. 1992. The Rise and Decline of Cerro Amaru: An Andean Shrine during the Early Intermediate Period and Middle Horizon. In Ancient images, Ancient Thought: The Archaeology of Ideology: Proceedings of the Twenty-Third Annual Conference of the Archaeological Association of the University of Calgary. The University of Calgary.

Torres-Rouff C. 2003. Shaping Identity: Cranial Vault Modification in the Pre-Columbian Andes. Doctoral Thesis: University of California.

Toyne M. 2008. Offering their Hearts and their Heads: A Bioarchaeological Analysis of of Ancient Human Sacrifice on the Northern Coast of Peru. Doctoral Thesis: Tulane University.

Trancho GJ, Robledo B, López-Bueis I and Sánchez JA. 1997. Sexual Determination of the Femur Using Discriminant Functions. Analysis of a Spanish Population of Known Sex and Age. Journal of Forensic Sciences 42(2):181-185.

Tung TA. 2003. A Biological Perspective on Wari Imperialism in the Andes of Peru: A View from Heartland and Hinterland Skeletal Populations. Doctoral Thesis: University of North Carolina at Chapel Hill

Turner II CG. 1983. Taphonomic Reconstruction of Human Violence and Cannibalism Based on Mass Burials in the American Southwest. In: LeMoine GM and MacEachern AS, editors. Carnivores, Human Scavengers and Predators: A Question of Bone Technology. Proceedings of the Fifteenth Annual Conference of the Archaeological Association of the University of Calgary. Calgary: The University of Calgary Archaeological Association, pp. 219-240.

Turner II CG and Turner JA. 1992. The First Claim for Cannibalism in the Southwest: Walter Hough's 1901 Discovery at Canyon Butte Ruin 3, Northeastern Arizona. American Antiquity 57(4):661-682.

Turner II CG and Turner JA. 1999. Man Corn: Cannibalism and Violence in the Prehistoric American Southwest. Salt Lake City: University of Utah Press.

Ubelaker DH. 1974. Reconstructing of Demographic Profiles from Ossuary Skeletal Samples: A Case Study from the Tidewater Potomoc. Smithsonian Contributions to Anthropology 18. Washington, DC: Smithsonian Institution Press.

Ubelaker DH. 1989. Human Skeletal Remains: Excavation, Analysis, Interpretation, Second Edition. Washington, DC: Taraxacum.

Uhle M. 1903. Pachacamac: Report of the William Pepper, MD, LLD, Peruvian Expedition of 1896. Philadelphia: University of Pennsylvania.

Valentin F and d'Errico F. 1995. Brief Communication: Skeletal Evidence of Operations on Cadavers from Sens (Yonne, France) at the End of the XVth Century. American Journal of Physical Anthropology 98:375-390.

van Vark GN, and Schaafsma W. 1992. Advances in the Quantitative Analysis of Skeletal Morphology. In: Saunders SR and Katzenberg MA, editors. Skeletal Biology of Past Peoples: Research Methods. New York: Wiley-Liss, pp. 225-257.

Verano JW. 1986. A Mass Burial of Mutilated Individuals at Pacatnumu. Donnan CB and Cock G, editors. Pacatnamú Papers, Volume 1. Los Angeles: University of California, Museum of Cultural History, pp. 117-138.

Verano JW. 1995. Where do They Rest? The Treatment of Human Offerings and Trophies in Ancient Peru. In: Dillehay TD, editor. Tombs for the Living: Andean Mortuary Practices. Washington, DC: Dumbarton Oaks Research Library and Collection, pp. 189-228.

Verano JW. 1997. Physical Characteristics and Skeletal Biology of the Moche Population at Pacatnamú. In: Donnan CB and Cock G, editors. Pacatnamú Papers, Volume 2. Los Angeles: University of California, Museum of Cultural History, pp. 189-215.

Verano JW. 2001. The Physical Evidence of Human Sacrifice in Ancient Peru. In: Benson EP and Cook AG, editors. Ritual Sacrifice in Ancient Peru. Austin: University of Texas Press, pp. 165-184.

Verano JW. 2003a. Human Skeletal Remains from Machu Picchu: A Re-examination of the Yale Peabody Museum's Collections. In: Burger RL and Salazar LC, editors. The 1912 Yale Peruvian Scientific Expedition Collections from Machu Picchu: Human and Animal Remains. New Haven: Yale University Publications in Anthropology, pp. 65-118.

Verano JW. 2003b. Trepanation in Prehistoric South America: Geographic and Temporal Trends over 2,000 Years. In: Arnott R, Finger S and Smith CUM, editors. Trepanation History, Discovery, Theory. Lisse: Swets and Zietlinger Publishers, pp. 223-236.

Verano JW. 2006. Human Sacrifice at El Brujo, Northern Peru. Report on 2005 Summer Field Research. Report to the National Geographic Society's Committee for Research and Exploration and the Roger Thayer Stone Center for Latin American Studies.

Verano JW, Anderson LS and Franco R. 2000. Foot Amputation by the Moche of Ancient Peru: Osteological Evidence and Archaeological Context. International Journal of Osteoarchaeology 10:177-188.

Villa P. 1992. Cannibalism in Prehistoric Europe. Evolutionary Anthropology 1:93-104.

Walker PL and Long JC. 1977. An Experimental Study of the Morphological Characteristics of Tool Marks. American Antiquity 42(4):605-616.

Walker PL, Johnson JR and Lambert PM. 1988. Age and Sex Biases in the Preservation of Human Skeletal Remains. American Journal of Physical Anthropology 76:189-188.

White CD, Nelson AJ, Longstaffe FJ, and Jung A. 2009. Landscape Bioarchaeology at Pacatnamu, Peru: Inferring Mobility from ^{13}C and ^{15}N Values in Hair. Unpublished.

White TD. 1986. Cut Marks on the Bodo Cranium: A Case of Prehistoric Defleshing. American Journal of Physical Anthropology 69:503-509.

White TD. 1992. Prehistoric Cannibalism at Mancos 5MTUMR-2346. Princeton: Princeton University Press.

White TD. 2000. Human Osteology, Second Edition. New York: Academic Press.

White TD and Folkens PA. 2005. The Human Bone Manual. New York: Elsevier Academic Press.

White TD and Folkens PA. 1991. Human Osteology. San Francisco: Academic Press.

White TE. 1953. A Method of Calculating the Dietary Percentage of Various Food Animals Utilized by Aboriginal Peoples. American Antiquity 4:396-398.

Willey P. 1990. Prehistoric Warfare on the Great Plains: Skeletal Analysis of the Croq Creek Massacre Victims. New York: Garland.

Willey P and Emerson TE. 1993. The Osteology and Archaeology of the Crow Creek Massacre. Plains Anthropologist 38(145):227-269.

Wittfogel KA. 1957. Oriental Despotism: A Comparative Study of Total Power. New Haven: Yale University Press.

Wood JW, Milner GR, Harpending HC and Weiss KM. 1992. The Osteological Paradox: Problems of Inferring Prehistoric Health from Skeletal Samples. Current Anthropology 33(4):343-370.

Workshop of European Anthropologists. 1980. Recommendations for Age and Sex Diagnoses of Skeletons. Journal of Human Evolution 9:517-549.

Wright LB and Vásquez MA. 2003. Estimating the Length of Incomplete Long Bones: Forensic Standards from Guatemala. American Journal of Physical Anthropology 120:233-251.

Yavuz MF, Isçan MY and Çöloğlu AS. 1998. Age Assessment by Rib Phase Analysis in Turks. Forensic Science International 98:47-54.

Yoder C, Ubelaker DH and Powell JF. 2001. Examination of Variation in Sternal Rib End Morphology Relevant to Age Assessment. Journal of Forensic Sciences 46(2):223-227.

Zimmerman LJ. 1997. The Crow Creek Massacre: Archaeology and Prehistoric Plains Warfare in Contemporary Contexts. In: Carman, editor. Material Harm: Archaeological Studies of War and Violence. Glasgow: Cruithne Press, pp. 75-94.

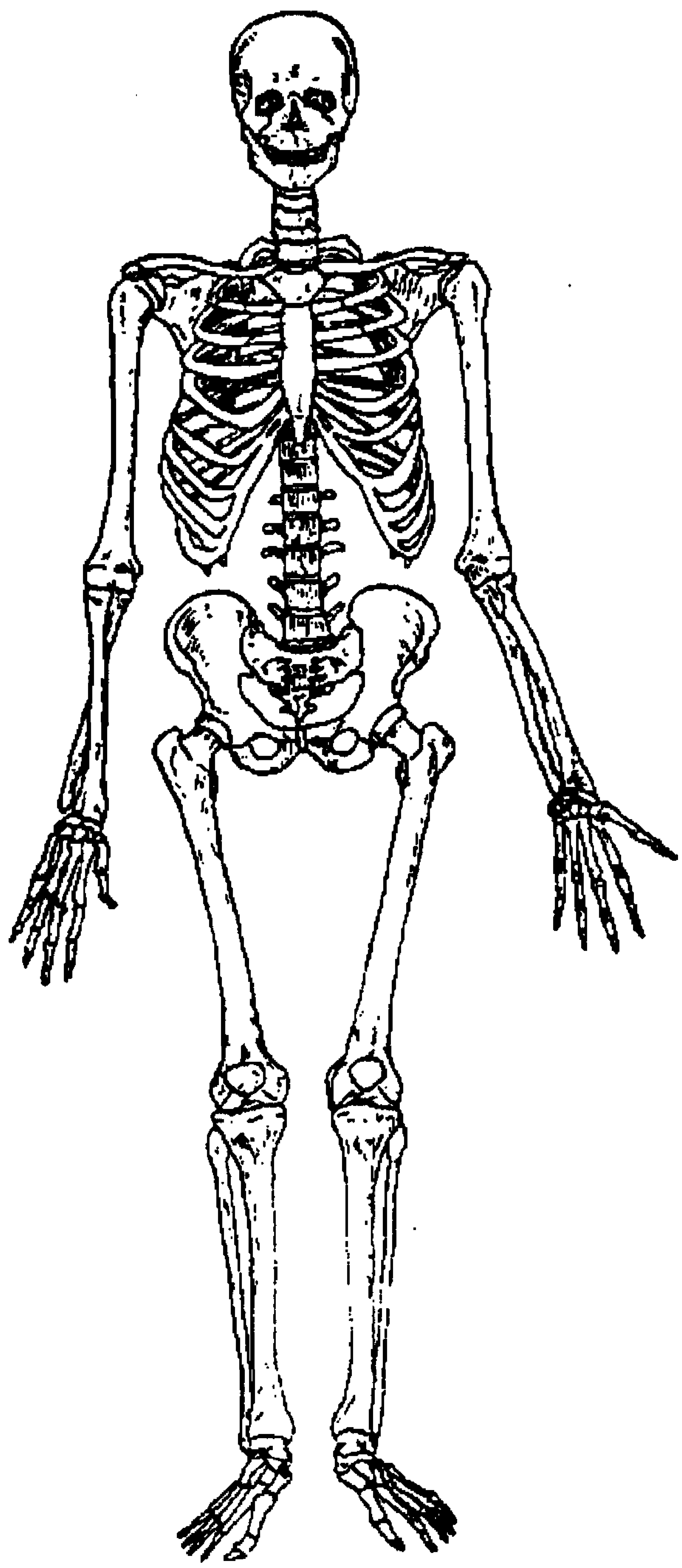
APPENDIX A: HUAMACHUCO SKELETAL RECORDING FORM
-- ADULT SKELETAL RECORDING FORM –
- SUMMARY SHEET -

Site Name: ______________________ Skeleton #: ______________________

Site Location: ____

Approximate Date, Period or Context: ________________________________

Recorded by: ______________________ Date Recorded: __________________



Additional information (X-rays, photos taken, number of additional written pages):

____
____
____
____

Sex: ____________

Age estimate: ________

Stature estimate (mean): ______cm
______ft ______in

State of Skeletal Preservation:
- good - fair - poor

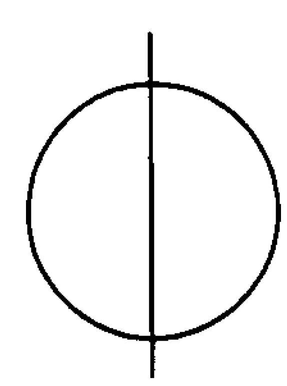
Type of Burial:

____
____
____

Position of Body:

____
____
____

Cranio-pelvic Axis Orientation:
- head pointing ______ - facing _____



Burial Goods:
- absent - present

Comment: ______________________________
____
____
____
____
____

SEX DETERMINATION

Pelvis	M F I	Skull	M F I
Sciatic Notch	_ _ _	Supraorbital Ridges	_ _ _
Subpubic Angle	_ _ _	Supraorbital margin	_ _ _
Preauricular Sulcus	_ _ _	Mastoid Process	_ _ _
Os Pubis	_ _ _	Nuchal Crest	_ _ _
Cheek Height ________	_ _ _	Mental Eminence	_ _ _

Metric/Conclusion/Discussion: ____

____

____

AGE DETERMINATION

Dental Eruption: M3 eruption? ____
Dental Wear: ________________________ Basis: ______________________________
Comments:____

____

* See pg. 6 of 9.

Pubic Symphysis - component or phase: ____
mean: ___________ range: __________ reference: __________

Medial Clavicle Epiph[28]: _________
Basi-Sphenoid Fusion[29]: _________
4th Sternal Rib End: _____________

Comments: ________________________

____

____

Conclusion: _____ to _____

Sutures (score 0,1,2,3; open-closed)

Vault		Lateral/Ant	
Midlambdoid	___	pterion	___
lambda	___	midcoronal	___
obelion	___	sphenofrontal	___
anterior sag	___	inf. sph. Temp	___
bregma	___	sup. sph. Temp	___
Composite Score:	___		___
Age Range	__________		__________

Stress Indicator Summary:

Dental Enamel Hypoplasia: (teeth involved, pits or lines, distance from cemento-enamel junction)

____

____

Porotic Hyperostosis: (includes cribra orbitalia - location, healed/unhealed, severity - light, moderate, severe)

____

____

Harris Lines: (number, thickness, degree of opacity, location, % of diaphysis crossed)

____

____

Site: _____________ Skeleton #: ___________ page 2 of 9

[28] No epiphysis = <18 years, Fusing epiphyseal Flake = 16 – 21 years, Epiphysis covers most of the articular surface = 24 -29 years and Complete Fusion = 29+ years

[29] The range of fusion of the speno-occipital synchondrosis/basi-spheniod is 11-16 is females and 13-18 in males.

Axial Bone Inventory

Skull	Right	Left	Comments
Complete			______
Frontal	__		______
Parietal	__	__	______
Occipital	__		______
Temporal	__	__	______
Sphenoid	__		______
Ethmoid	__		______
Zygomatic	__	__	______
Inf. Nas. Conch	__	__	______
Lacrimal	__	__	______
Nasal	__	__	______
Vomer	__		______
Palatine	__	__	______
Maxillae	__	__	______
Mandible	__		______
Hyoid	__		______

Fragments: ______
Comments: ______

Spine

Cervical		Comments
C1	__	______
C2	__	______
C3	__	______
C4	__	______
C5	__	______
C6	__	______
C7	__	______

Position undetermined: ______

Lumbar		
L1	__	______
L2	__	______
L3	__	______
L4	__	______
L5	__	______

Position undetermined: ______

Thoracic		Comments
T1	__	______
T2	__	______
T3	__	______
T4	__	______
T5	__	______
T6	__	______
T7	__	______
T8	__	______
T9	__	______
T10	__	______
T11	__	______
T12	__	______

Position undetermined: ______

Segmentation Errors: ______

Manubrium __ ______
Sternal Body __ ______
Xiphoid __ ______

Ribs: complete: R ______ L ______ Fragments: ______

Total Rib Curvature (TRC)= TVS/TVC * 100
= ______/______ * 100
= ______

Sesamoid or Accessory Bones: ______

Comments: ______

Appendicular Bone Inventory

	Right	Left	Comments
Clavicle	__	__	________________
Scapula	__	__	________________
Humerus	__	__	________________
Radius	__	__	________________
Ulna	__	__	________________
Carpals	__	__	________________

	Right	Left		Right	Left
Scaphoid	__	__	Trapezium	__	__
Lunate	__	__	Trapezoid	__	__
Triquetral	__	__	Capitate	__	__
Pisiform	__	__	Hamate	__	__
Metacarpals	__	__	________________		
First	__	__	Fourth	__	__
Second	__	__	Fifth	__	__
Third	__	__			
Phalanges			________________		

1st row R __ L __ ? __ 2nd row R __ L __ ? __ 3rd row R __ L __ ? __

	Right	Left	Comments
Sacrum	__		________________
Coccyx	__		________________
Innominate	__	__	________________
Ilium	__	__	________________
Ischium	__	__	________________
Pubis	__	__	________________
Femur	__	__	________________
Patella	__	__	________________
Tibia	__	__	________________
Fibula	__	__	________________
Tarsals	__	__	________________

	Right	Left		Right	Left
Talus	__	__	Med. Cuneiform	__	__
Calcaneus	__	__	Int. Cuneiform	__	__
Navicular	__	__	Lat. Cuneiform	__	__
Cuboid	__	__			
Metatarsals	__	__	________________		
First	__	__	Fourth	__	__
Second	__	__	Fifth	__	__
Third	__	__			
Phalanges			________________		

1st row R __ L __ ? __ 2nd row R __ L __ ? __ 3rd row R __ L __ ? __

Sesamoid or Accessory Bones: ________________

Unidentifiable Fragments: ________________

Comments: ________________

____

____

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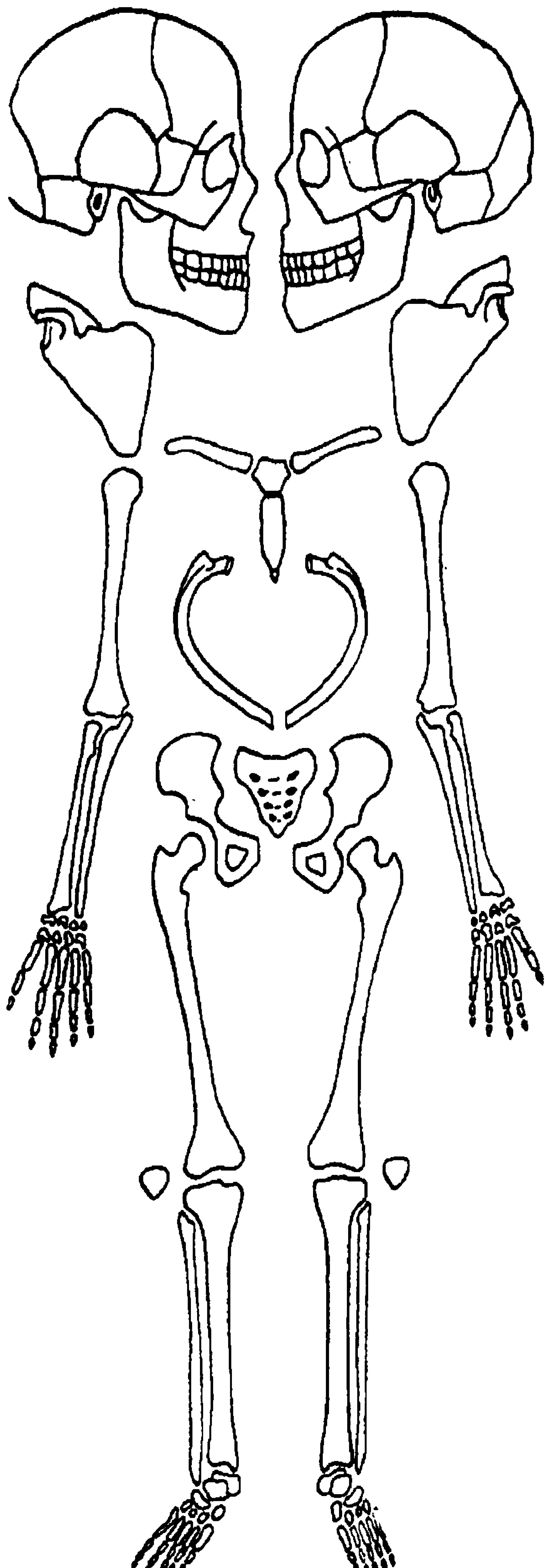
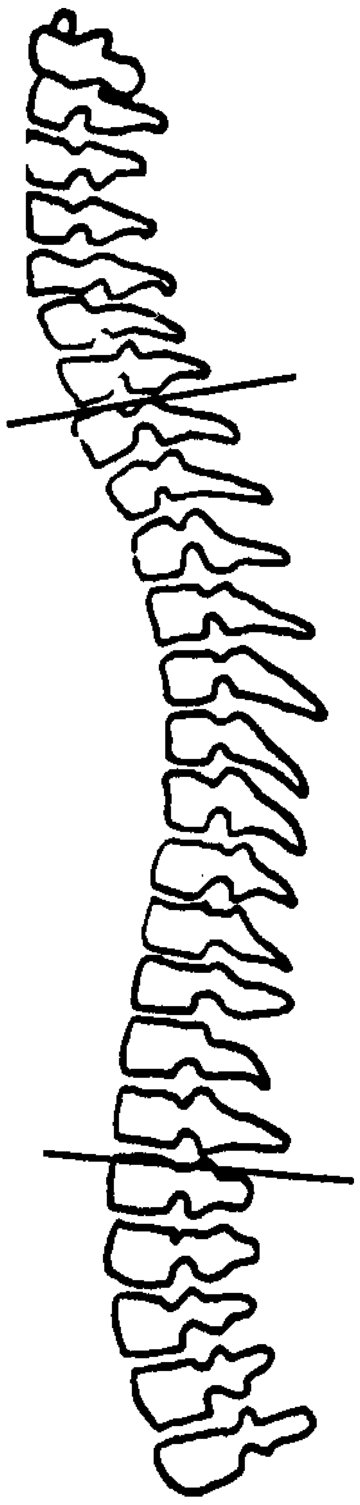


General Pathology

Comments: ______________________________

Site: ______________ Skeleton #: ____________



Spinal Pathology

Comments: ____

____

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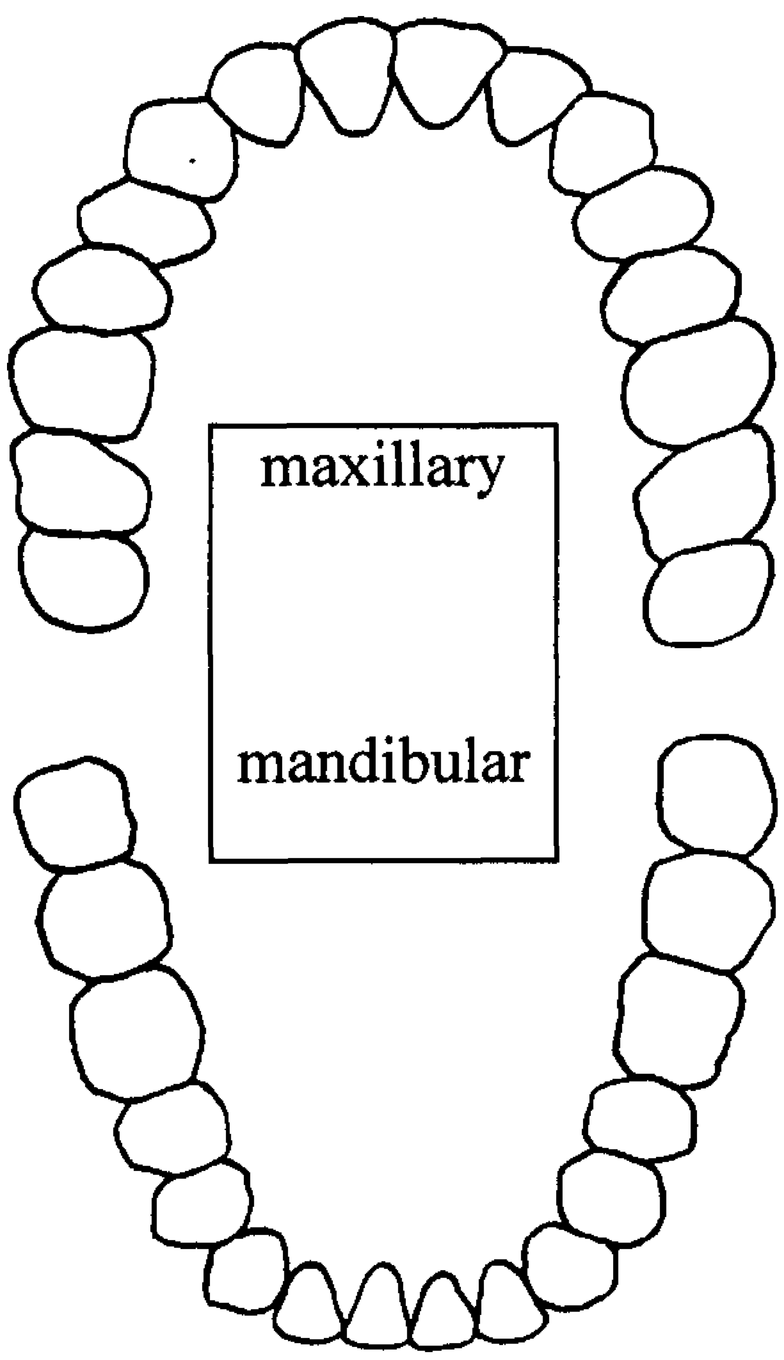
Key: superior articular facet = SAF inferior AF = IAF
upper demi-facet = UDF lower demi-facet = LDF
tubercle facet = TF right = R left = L



Dental Pathology

Comments: ______________________

____

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____

Key: CO = caries on occlusal surface
CI = interproximal caries
CC = cervical caries K = calculus
AR = alveolar resorption
SUP = supragingival
SUB = subgingival
AB = abscess H = hypoplasia
- shade for wear pattern

Site: ____________ Skeleton #: ____________

Cranial Metrics (three letter abbreviations after W.W. Howells)

Calvaria

1) Maximum cranial length (G-Op) (GOL) __________ Cranial Index:
2) Maximum cranial breadth (Bi-Eu) (XCB) __________ (XCB/GOL)*100
3) Maximum circumference __________ = __________
4) Basion-nasion height (Ba-Na) (BNL) __________
5) Basion-bregma height (Ba-Br) (BBH) __________
6) Biauricular breadth (AUB) __________
7) Biasterionic breadth (Bi-As) (ASB) __________
8) Mastoid length (MDH) (left) __________
9) Foramen magnum length (FOL) __________
10) Foramen magnum breadth __________
11) Frontal chord (Na-Br) (FRC) __________ Frontal Arc __________
12) Parietal chord (Br-La) (PAC) __________ Parietal Arc __________
13) Occipital chord (La-Op) (OCC) __________ Occipital Arc __________ 14)
Lambda-Inion chord (La-In) __________
15) Inion-Opisthion chord (In-Op) __________

Face

16) Basion-prosthion length (BPL) __________
17) Upper facial height (NPH) __________
18) Total facial height (Gn-Na) __________
19) Maximum frontal breadth (XFB) __________
20) Minimum frontal breadth __________
21) Bifrontal breadth (FMT-FMT) __________
22) Bistephanic breadth (STB) __________
23) Bizygomatic breadth (Bi-Zy) (ZYB) __________
24) Bimaxillary breadth (Bi-Zm:a) (ZMB) __________
25) Nasal height (NLH) __________
26) Nasal breadth (NLB) __________
27) Orbit height, left (OBH) __________
28) Orbit breadth, left (OBB) __________
29) Interorbital breadth (Bi-Dk) (DKB) __________
30) Biorbital breadth (Bi-Ec) (EKB) __________
31) Bijugal breadth (JUB) __________
32) Palate breadth, external (MAB) __________
33) External palatal length (Pr-Alv) __________
34) Malar length, inferior (IML) (left) __________
35) Malar length, maximum (XML) (left) __________
36) Cheek height (WMH) (left) __________

Bone Thickness

Midfrontal ________ Midfrontal off crest ________
Bregma ________
Parietal Boss - right ________ left __________
- left ASP __________ left PSP __________
Midtemporal (left) __________
Inion ________

Additional Dental Metrics:

Intercanine breadth - maxilla: _______
Intercanine breadth - mand: ________
(both at lateral edge of base)

Mandible Measurements

Bigonial breadth ________ Symphysis height ________ M1 MD diameter __________
Bicondylar breadth ________ Body height (@ l M2) ________ M1 BL diameter __________
Ramus min. br. (left)_______ Body width (@ l M2) ________
Ramus height (left) ________ M1-M3 length (left) ________

Site: ______________ Skeleton #: ____________

Postcranial Metrics

Measurement (SOD Equivalent, my code)	Right	Left
Humerus - maximum length (HuL1) (cm) (40/H1)	_____	_____
- longitudinal head length (42/H3)	_____	_____
- articular width (mm) (H4)	_____	_____
- epicondylar breadth (mm) (41/HM4)	_____	_____
- midshaft - AP diameter (mm) (H21)	_____	_____
- ML diameter (mm) (H22)	_____	_____
- circumference (mm) (H23)	_____	_____
- maximum diameter (mm) (43/HM5)	_____	_____
- minimum diameter (mm) (44/HM6)	_____	_____
- least circumference (mm) (HM7)	_____	_____
Radius - maximum length (RaL1) (cm) (45/R1)	_____	_____
- midshaft circumference	_____	_____
Ulna - maximum length (UlL1) (cm) (48/U1)	_____	_____
- midshaft circumference	_____	_____
Second Metacarpal - maximum length (mm) (M1)	_____	_____
- midshaft - AP diameter (mm) (M11)	_____	_____
- ML diameter (mm) (M12)	_____	_____
- circumference (mm) (M13)	_____	_____
Femur - maximum length (FeL1) (cm) (60/F1)	_____	_____
- oblique length (FeL2) (cm) (61/FM2)	_____	_____
- longitudinal head length (mm) (F4)	_____	_____
- distal articular breadth (mm) (F5)	_____	_____
- biepicondylar breadth (mm) (62/FM21)	_____	_____
- subtrochanteric a/p diameter (FeD1) (mm)(64/F11)	_____	_____
- subtrochanteric m/l diameter (FeD2) (mm)(65/F12)	_____	_____
- subtrochanteric circumference (mm) (F13)	_____	_____
- midshaft ant/post diameter (FeD3) (mm) (66/F31)	_____	_____
- midshaft med/lat diameter (FeD4) (mm) (67/F32)	_____	_____
- midshaft circumference (mm) (68/F33)	_____	_____
Tibia - total length (w/o spine) (TiL2) (mm) (69/T1)	_____	_____
- condylo-astragalar length (mm/T2)	_____	_____
- proximal articular breadth (mm) (70/T4)	_____	_____
- distal AP (mm) (T5)	_____	_____
- AP diameter at nut. foramen (TiD2) (mm) (72/T11)	_____	_____
- ML diameter at nut. foramen (TiD1) (mm) (73/T12)	_____	_____
- circumference at nutrient foramen (mm) (74/T13)	_____	_____
- midshaft - AP diameter (mm) (T31)	_____	_____
- ML diameter (mm) (T32)	_____	_____
- circumference (mm) (T33)	_____	_____
Fibula - maximum length (FiL1) (cm) (75/F1)	_____	_____
Clavicle - maximum length (mm) (35/C1)	_____	_____
- midshaft circumference	_____	_____
Scapula - glenoid fossa length (mm) (Sc1)	_____	_____
Sacrum - anterior length (mm) (53) (Sa1)		_____
- anterior superior breadth (54) (Sa2)		_____

Stature from H1
right left SE
_____ _____ ____ (T&G)

Robusticity Index:
(HM7/H1)*100: _____

Brachial index:
(R1/H1)*100 = ______

Stature from RaL1
right left SE
_____ _____ __ (T&G)

Stature from UlL1
_____ _____ _____ (T&G)

Stature from F1
right left SE
____ ____ ____ (T&G)
____ ____ ____ (Gen)

Platymeric Index:
(F11/F12)*100: ___ ___

Pilastric Index:
(F31/F32)*100: ___ ___

Robusticity Index:
((F31+F32)/FM2)*100: _____ _____

Stature from T1 (TiL2)
right left SE
_____ _____ ___ (T&G)
_____ _____ ___ (Gen)

Platycnemic Index:
(T12/T11)*100: ___ ___

Crural Index:
(T1/F1)*100: ____ ____

Stature from FiL1
right left SE
_____ _____ ___ (T&G)

Stature Summary:
T&G: ____________
Gen: ____________

Site: _____________ Skeleton #: ___________

Non-Metric Morphological Traits

Cranium	right	left
C1. Metopism (P/A/G/B)	__	
C2. Fronto-temporal Artic (N/C/I)	__	__
C3. Foramina		
a. Supraorbital Structures (P/A/N)	__	__
b. Parietal (P/A)	__	__
c. Huschke's (P/A)	__	__
d. P condylar canal (O/C)	__	__
e. Divided Hypoglossal (C/I)	__	__
f. Foramen Ovale (C/I)	__	__
g. Foramen Spinosum (C/I)	__	__
h. Mastoid (P/A)	__	__
i. Zygomatico-facial (A/#)	__	__
j. Acc. Infraorbital (A/#)	__	__
k. Supratrochlear (P/A)	__	__
C4. Wormian Bones		
a. Coronal (P/A)	__	__
b. Sagittal (P/A)	__	
c. Lambdoid (P/A)	__	__
d. Occipito-Temporal (P/A)	__	__
C5. Supernumery Bones		
a. Bregmatic Bone (P/A)	__	
b. Lambdoid/Apical Bone (P/A)	__	
c. Asterionic Bone (P/A)	__	__
d. Parietal Notch (P/A)	__	__
e. Os Japonicum (P/A)	__	__
f. Os Inca (P/A)	__	
C6. Torus		
a. Maxillaris (P/A)	__	__
b. Palatinus (P/A)	__	
C7. Auditory Exostoses (P/A)	__	__
C8. Condylar facet (S/D)	__	__
C9. Precondylar tubercle (P/A)	__	__
C10. Paracondylar Process (P/A)	__	__
C11. Clinoid Bridges/Spurs (P/A)	__	__

Sternum	right	left
Manubrio-corpal Synostosis (P/A)	__	
Sternal Aperture (P/A)	__	
Scapula		
Suprascapular (A/N/F)	__	__
Vertebrae		
Atlas - Posterior Bridge (P/A)	__	__
- Lateral Bridge (P/A)	__	__
Sacrum - Level of Open Hiatus (#)	__	
Butterfly Vertebrae (P/A) and #	________	
Humerus		
Septal Aperture (P/A)	__	__
Supracondylar Process (P/A)	__	__
Femur		
Third Trochanter (P/A)	__	__
Allen's Fossa (P/A)	__	__
Poirier's Facet (A/F/P)	__	__
Tibia		
Squatting Facets (A/M/L/B)	__	__
Talus		
Medial Talar Facet (S/D)	__	__
Patella		
Vastus Notch (P/A)	__	__
Mandible		
M1. Mylohyoid Groove/Bridge (G/B	__	__
M2. Torus Mandibularis (P/A)	__	__
M3. Gonial Eversion (P/A)	__	__
M4. Multiple Mental Foramina (S/#)	__	__
Tarsals/Metatarsals (Kissing Facets)		
Cuneiforms (P/A) #: ______	__	__
Proximal Metatarsals (P/A)#: ______	__	__

Additional Comments: ____

APPENDIX B: MINI PILOT STUDY – MORPHOLOGICAL VS. METRIC: A COMPARISON OF SEX ON SKELETAL SAMPLES FROM PACATNAMU AND SAN JOSE DE MORO

The archaeological site of Pacatnamu was a large urban centre located in the Jequetepeque Valley on the North Coast of Peru. Through archaeological analysis, it has been shown that the site has been occupied from Moche (ca. AD 350) to Lambayeque (Sican – ca. AD 1370) times (Donnan 1997; White *et al.* 2009).

The archaeological site of San Jose de Moro was an extensive prehistoric occupation on the North Coast of Peru. The site was continuously occupied from the Middle/Late Moche period (AD 450) until Chimu/Inca period (AD 1500). The site's occupation ended with the Spanish conquest (Nelson 1998).

ID	Burial	Time Period	Foramen Magnum Length (mm)	Foramen Magnum Breadth (mm)	Discriminant Function Analysis	Discriminant Function Sex Determination	Skeletal Sex Determination
P3	M II	Lambayeque	28.2	25.0	1.241	Female	Female
P5	e1d alpha	Late Moche	33.9	29.4	0.685	Female	Male
P6	e 1f	Lambayeque	33.7	29.6	0.688	Female	Male
P7	15	Mid Moche	33.6	31.5	0.607	Female	Male
P8	m 9	Lambayeque	34.8	28.7	0.661	Female	Male
SJM1	1	Chimu	32.5	25.6	0.946	Female	Female
SJM2	313	Mid Moche	31.5	29.4	0.834	Female	Female
SJM4	412	Lambayeque	35.9	31	0.487	Male	Female
SJM8	319	Mid Moche	32.6	30.5	0.715	Female	Male
SJM9	401	Lambayeque	30.6	26.4	1.028	Female	Male
SJM12	513	Transitional	30.0	35.0	0.670	Female	Male

Table B. 1: Discriminant function analysis of the foramen magnum based on Holland (1986).
Individuals with a score on a discriminant function greater than 0.5 are classified as females; those with a score less than 0.5 are classified as males; those with a score equal to 0.5 are unclassified.

Note: The Lambayeque skulls are fronto-occipitally modified, which can shorten the cranial base. Therefore, the results of the metric analysis may be invalid.

ID	Burial	Time Period	Bone	Side	Circumference at NF (mm)	Discrimin. Function Analysis	Sex Determin. (SP = 0.252)	Skeletal Sex Determin.
P1	c 1	Unknown	Tibia	Right	77	-1.772	Female	Female
P2	d 6	Lambayeque	Tibia	Right	85	-0.220	Female	Female
P3	m II	Lambayeque	Tibia	Right	77	-1.772	Female	Female
P4	e1a offering 4	Late Moche	Tibia	Right	91	0.944	Male	Male
P5	e 1d alpha	Late Moche	Tibia	Right	80	-1.190	Female	Male
P6	e 1f	Lambayeque	Tibia	Right	94	1.526	Male	Male
P7	1 5	Mid Moche	Tibia	Right	93	1.332	Male	Male
P8	m 9	Lambayeque	Tibia	Right	101	2.884	Male	Male
SJM1	1	Chimu	Tibia	Right	71	-2.936	Female	Female
SJM2	313	Mid Moche	Tibia	Right	93	1.332	Male	Female
SJM3	316	Cajamarca	Tibia	Right	72	-2.742	Female	Female
SJM5	501	Lambayeque	Tibia	Right	78	-1.578	Female	Female
SJM6	502	Lambayeque	Tibia	Right	75	-2.160	Female	Female
SJM7	509a	Late Moche	Tibia	Right	90	0.750	Male	Female
SJM8	319	Mid Moche	Tibia	Right	96	1.914	Male	Male
SJM9	401	Lambayeque	Tibia	Right	92	1.138	Male	Male
SJM10	416	Mid Moche	Tibia	Right	88	0.362	Male	Male
SJM11	503	Lambayeque	Tibia	Right	95	1.720	Male	Male

Table B. 2: Discriminant function analysis of the tibia based on Safont *et al.* (2000).
Individuals with a score on a discriminant function greater than the sectioning point (SP) 0.252 are classified as males; those with a score less than 0.252 are classified as females; those with a score equal to 0.252 are unclassified.

ID	Burial	Time Period	Bone	Side	Circumference at NF (mm)	Discrimin. Function Analysis	Sex Determin. (SP = 0.0)	Skeletal Sex Determin.
P1	c 1	Unknown	Tibia	Left	74	-2.354	Female	Female
P2	d 6	Lambayeque	Tibia	Left	81	-0.996	Female	Female
P3	m II	Lambayeque	Tibia	Left	80	-1.190	Female	Female
P5	e 1d alpha	Late Moche	Tibia	Left	79	-1.384	Female	Male
P6	e 1f	Lambayeque	Tibia	Left	94	1.526	Male	Male
P7	1 5	Mid Moche	Tibia	Left	87	0.168	Male	Male
P8	m 9	Lambayeque	Tibia	Left	98	2.302	Male	Male
SJM1	1	Chimu	Tibia	Left	71	-2.936	Female	Female
SJM2	313	Mid Moche	Tibia	Left	93	1.332	Male	Female
SJM3	316	Cajamarca	Tibia	Left	72	-2.742	Female	Female
SJM5	501	Lambayeque	Tibia	Left	81	-0.996	Female	Female
SJM6	502	Lambayeque	Tibia	Left	77	-1.772	Female	Female
SJM9	401	Lambayeque	Tibia	Left	78	-1.578	Female	Male
SJM10	416	Mid Moche	Tibia	Left	85	-0.220	Female	Male
SJM11	503	Lambayeque	Tibia	Left	72	-2.742	Female	Male

Table B. 3: Discriminant function analysis of the tibia based on Safont *et al.* (2000).
Individuals with a score on a discriminant function greater than the sectioning point (SP) 0.252 are classified as males; those with a score less than 0.252 are classified as females; those with a score equal to 0.252 are unclassified.

ID	Burial	Time Period	Bone	Side	Transverse Diameter at NF (mm)	Discrimin. Function Analysis	Sex Determin. (SP = 0.0)	Skeletal Sex Determin.
P1	c 1	Unknown	Tibia	Right	18.4	-8.246	Female	Female
P2	d 6	Lambayeque	Tibia	Right	20.4	-4.514	Female	Female
P3	m II	Lambayeque	Tibia	Right	21.8	-1.901	Female	Female
P4	e1a offering 4	Late Moche	Tibia	Right	24.1	2.391	Male	Male
P5	e 1d alpha	Late Moche	Tibia	Right	22.4	-0.782	Female	Male
P6	e 1f	Lambayeque	Tibia	Right	21.6	-2.274	Female	Male
P7	15	Mid Moche	Tibia	Right	25.0	4.070	Male	Male
P8	m 9	Lambayeque	Tibia	Right	24.3	2.764	Male	Male
SJM1	1	Chimu	Tibia	Right	16.7	-11.418	Female	Female
SJM2	313	Mid Moche	Tibia	Right	23.9	2.017	Male	Female
SJM3	316	Cajamarca	Tibia	Right	19.6	-6.006	Female	Female
SJM4	412	Lambayeque	Tibia	Right	20.0	-5.260	Female	Female
SJM5	501	Lambayeque	Tibia	Right	21.5	-2.461	Female	Female
SJM6	502	Lambayeque	Tibia	Right	20.3	-4.700	Female	Female
SJM7	509a	Late Moche	Tibia	Right	19.9	-5.447	Female	Female
SJM8	319	Mid Moche	Tibia	Right	26.7	7.242	Male	Male
SJM9	401	Lambayeque	Tibia	Right	20.9	-3.581	Female	Male
SJM10	416	Mid Moche	Tibia	Right	22.0	-1.528	Female	Male
SJM11	503	Lambayeque	Tibia	Right	22.4	-0.782	Female	Male

Table B. 4: Discriminant function analysis of the tibia based on González-Reimers *et al.* (2000). Individuals with a score on a discriminant function greater than the 0.0 sectioning point (SP) are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

ID	Burial	Time Period	Bone	Side	Transverse Diameter at NF (mm)	Discrimin. Function Analysis	Sex Determin. (SP = 0.0)	Skeletal Sex Determin.
P1	c 1	Unknown	Tibia	Left	18.0	-8.992	Female	Female
P2	d 6	Lambayeque	Tibia	Left	20.6	-4.140	Female	Female
P3	m II	Lambayeque	Tibia	Left	22.4	-0.782	Female	Female
P5	e 1d alpha	Late Moche	Tibia	Left	22.1	-1.341	Female	Male
P6	e 1f	Lambayeque	Tibia	Left	22.3	-0.968	Female	Male
P7	15	Mid Moche	Tibia	Left	23.8	1.831	Male	Male
P8	m 9	Lambayeque	Tibia	Left	23.7	1.644	Male	Male
SJM1	1	Chimu	Tibia	Left	16.7	-11.418	Female	Female
SJM2	313	Mid Moche	Tibia	Left	22.4	-0.782	Female	Female
SJM3	316	Cajamarca	Tibia	Left	19.7	-5.820	Female	Female
SJM4	412	Lambayeque	Tibia	Left	20.0	-5.260	Female	Female
SJM5	501	Lambayeque	Tibia	Left	21.8	-1.901	Female	Female
SJM6	502	Lambayeque	Tibia	Left	19.7	-5.820	Female	Female
SJM7	509a	Late Moche	Tibia	Left	18.2	-8.619	Female	Female
SJM9	401	Lambayeque	Tibia	Left	21.1	-3.207	Female	Male
SJM10	416	Mid Moche	Tibia	Left	24.0	2.204	Male	Male
SJM11	503	Lambayeque	Tibia	Left	23.6	1.458	Male	Male

Table B. 5: Discriminant function analysis of the tibia based on González-Reimers *et al.* (2000).
Individuals with a score on a discriminant function greater than the 0.0 sectioning point (SP) are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

ID	Burial	Time Period	Bone	Side	Midshaft Circum. (mm)	Discrim. Function (Black 1978)	Sex Determ. (SP = 0.0)	Discrim. Function (Safont *et al.* 2000)	Sex Determ. (SP = 0.182)	Skeletal Sex Determin.
P1	c 1	Unknown	Femur	Right	76	-5	Female	-1.316	Female	Female
P2	d 6	Lambayeque	Femur	Right	73	-8	Female	-1.883	Female	Female
P3	m II	Lambayeque	Femur	Right	71	-10	Female	-2.261	Female	Female
P4	e1a offering 4	Late Moche	Femur	Right	81	0	Indeterminate	-0.371	Female	Male
P5	e 1d alpha	Late Moche	Femur	Right	79	-2	Female	-0.749	Female	Male
P6	e 1f	Lambayeque	Femur	Right	88	7	Male	0.952	Male	Male
SJM1	1	Chimu	Femur	Right	81	0	Indeterminate	-0.371	Female	Female
SJM3	316	Cajamarca	Femur	Right	94	13	Male	2.086	Male	Female
SJM4	412	Lambayeque	Femur	Right	69	-12	Female	-2.639	Female	Female
SJM5	501	Lambayeque	Femur	Right	83	2	Male	0.007	Female	Female
SJM6	502	Lambayeque	Femur	Right	70	-11	Female	-2.450	Female	Female
SJM7	509a	Late Moche	Femur	Right	80	-1	Female	-0.560	Female	Female
SJM10	416	Mid Moche	Femur	Right	86	5	Male	0.574	Male	Male
SJM11	503	Lambayeque	Femur	Right	85	4	Male	0.385	Male	Male
SJM12	513	Transitional	Femur	Right	95	14	Male	2.275	Male	Male

Table B. 6: Discriminant function analysis of the femur based on Black III (1978) and Safont *et al.* (2000).
Individuals with a score on a discriminant function greater than the sectioning point (SP) of 0.0/0.182 are classified as males; those with a score less than 0.0/0.182 are classified as females; those with a score equal to 0.0/0.182 are unclassified.

ID	Burial	Time Period	Bone	Side	Midshaft Circum. (mm)	Discrim. Function (Black 1978)	Sex Determ. (SP = 0.0)	Discrim. Function (Safont *et al.* 2000)	Sex Determ. (SP = 0.182)	Skeletal Sex Determin.
P1	c 1	Unknown	Femur	Right	76	-5	Female	-1.316	Female	Female
P2	d 6	Lambayeque	Femur	Right	73	-8	Female	-1.883	Female	Female
P3	m II	Lambayeque	Femur	Right	71	-10	Female	-2.261	Female	Female
P4	e1a offering 4	Late Moche	Femur	Right	81	0	Indeterminate	-0.371	Female	Male
P5	e 1d alpha	Late Moche	Femur	Right	79	-2	Female	-0.749	Female	Male
P6	e 1f	Lambayeque	Femur	Right	88	7	Male	0.952	Male	Male
SJM1	1	Chimu	Femur	Right	81	0	Indeterminate	-0.371	Female	Female
SJM3	316	Cajamarca	Femur	Right	94	13	Male	2.086	Male	Female
SJM4	412	Lambayeque	Femur	Right	69	-12	Female	-2.639	Female	Female
SJM5	501	Lambayeque	Femur	Right	83	2	Male	0.007	Female	Female
SJM6	502	Lambayeque	Femur	Right	70	-11	Female	-2.450	Female	Female
SJM7	509a	Late Moche	Femur	Right	80	-1	Female	-0.560	Female	Female
SJM10	416	Mid Moche	Femur	Right	86	5	Male	0.574	Male	Male
SJM11	503	Lambayeque	Femur	Right	85	4	Male	0.385	Male	Male
SJM12	513	Transitional	Femur	Right	95	14	Male	2.275	Male	Male

Table B. 6: Discriminant function analysis of the femur based on Black III (1978) and Safont *et al.* (2000). Individuals with a score on a discriminant function greater than the sectioning point (SP) of 0.0/0.182 are classified as males; those with a score less than 0.0/0.182 are classified as females; those with a score equal to 0.0/0.182 are unclassified.

ID	Burial	Time Period	Bone	Side	Bi-condylar Length (mm)	Max Head Diameter (mm)	Discrim. Function Analysis	Sex Determin. (SP = 0.0)	Skeletal Sex Determin.
P1	c 1	Unknown	Femur	Right	70.6	42.4	-1.668	Female	Female
P2	d 6	Lambayeque	Femur	Right	67.9	41.4	-2.664	Female	Female
P3	m II	Lambayeque	Femur	Right	69.5	37.8	-2.848	Female	Female
P4	e1a offering 4	Late Moche	Femur	Right	74.7	44.3	-0.085	Female	Male
P5	e 1d alpha	Late Moche	Femur	Right	72.3	38.6	-1.859	Female	Male
P6	e 1f	Lambayeque	Femur	Right	78.4	41.6	0.527	Male	Male
P7	1 5	Mid Moche	Femur	Right	82.3	45.0	2.327	Male	Male
P8	m 9	Lambayeque	Femur	Right	84.8	49.5	3.909	Male	Male
SJM1	1	Chimu	Femur	Right		36.8	-3.124	Female	Female
SJM3	316	Cajamarca	Femur	Right		41.2	-1.064	Female	Female
SJM4	412	Lambayeque	Femur	Right	70.0	39.0	-2.476	Female	Female
SJM5	501	Lambayeque	Femur	Right		40.0	-1.626	Female	Female
SJM6	502	Lambayeque	Femur	Right	64.9	37.0	-4.378	Female	Female
SJM7	509a	Late Moche	Femur	Right		45.0	0.715	Male	Female
SJM8	319	Mid Moche	Femur	Right	77.9	45.1	1.024	Male	Male
SJM9	401	Lambayeque	Femur	Right		48.0	2.119	Male	Male
SJM10	416	Mid Moche	Femur	Right	77.0	46.0	0.920	Male	Male
SJM11	503	Lambayeque	Femur	Right	80.4	43.0	1.387	Male	Male
SJM12	513	Transitional	Femur	Right	83.5	41.0	1.949	Male	Male

Table B. 8: Discriminant function analysis of the Femur based on Trancho *et al.* (1997).
Individuals with a score on a discriminant function greater than the 0.0 sectioning point (SP) are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

ID	Burial	Time Period	Bone	Side	Bi-condylar Length (mm)	Max Head Diameter (mm)	Discrim. Function Analysis	Sex Determin. (SP = 0.0)	Skeletal Sex Determin.
P1	c 1	Unknown	Femur	Left	69.8	42.1	-1.964	Female	female
P3	m II	Lambayeque	Femur	Left	70.7	37.7	-2.506	Female	female
P4	e1a offering 4	Late Moche	Femur	Left	75.2	46.3	0.434	Male	male
P5	e 1d alpha	Late Moche	Femur	Left	70.5	37.4	-2.622	Female	male
P6	e 1f	Lambayeque	Femur	Left	78.1	42.0	0.511	Male	male
P7	1 5	Mid Moche	Femur	Left		45.6	0.996	Male	male
P8	m 9	Lambayeque	Femur	Left	85.4	48.9	3.978	Male	male
SJM1	1	Chimu	Femur	Left		37.4	-2.843	Female	female
SJM2	313	Mid Moche	Femur	Left	75.4	42.5	-0.208	Female	female
SJM3	316	Cajamarca	Femur	Left		40.1	-1.579	Female	female
SJM4	412	Lambayeque	Femur	Left	71.0	38.0	-2.361	Female	female
SJM5	501	Lambayeque	Femur	Left		39.5	-1.860	Female	female
SJM6	502	Lambayeque	Femur	Left	64.5	36.5	-4.590	Female	female
SJM7	509a	Late Moche	Femur	Left	80.0	45.1	1.654	Male	female
SJM8	319	Mid Moche	Femur	Left	82.6	44.9	2.399	Male	male
SJM9	401	Lambayeque	Femur	Left	78.0	48.0	1.589	Male	male
SJM10	416	Mid Moche	Femur	Left	78.0	47.0	1.405	Male	male
SJM11	503	Lambayeque	Femur	Left	78.5	43.0	0.816	Male	male
SJM12	513	Transitional	Femur	Left	80.7	46.0	2.031	Male	male

Table B. 9: Discriminant function analysis of the Femur based on Trancho *et al.* (1997).
Individuals with a score on a discriminant function greater than the 0.0 sectioning point (SP) are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

APPENDIX C: LANDMARKS USED TO ESTIMATE INCOMPLETE LONG BONE LENGTH

Bone	Landmark (this study)	Landmark (Steele, 1970)	Position of bone	Definition of landmark
Humerus	H0	1	Prone	Most proximal point on the head
	H1		Supine	Most proximal point of the greater tuberosity
	H2		Supine	Most projecting proximal point on the lesser tuberosity, along its lateral border
	H3	2	Prone	Most distal point of circumference of the head
	H4[1]		Supine	Most distal point of the deltoid tuberosity, where the two deltoid lines join
	H5	3	Prone	Proximal margin of the olecranon fossa
	H6	4	Prone	Distal margin of the olecranon fossa
	H7	5	Prone	Most distal point of the trochlea
Femur	F0	1	Prone	Most proximal point on the head
	F1		Prone	Most proximal point on the greater trochanter
	F2	2	Prone	Midpoint of the lesser trochanter
	F3[2]		Prone	Distal limit of smooth bone between the union of the pectineal line and linea aspera, at which point the intersection of the lines is filled with rough bone
	F4[1]	3	Prone	Most proximal extension of the popliteal surface at point where the medial and lateral supracondylar lines become parallel below the linea aspera
	F5	4	Prone	Most proximal point on margin of the intercondylar fossa
	F6	5	Prone	Most distal point of the medial condyle
Tibia	T7	1	Supine	Most prominent point on the lateral half of the lateral condyle
	T6	2	Supine	Most proximal point of the tibial tuberosity
	T5[1]		Supine	Point at which the anterior crest crosses the central axis of tibia, as drawn through the tibial tuberosity
	T4[1]		Prone	Nutrient foramen
	T3[1]		Prone	Point on the popliteal line where it crosses over the medial angle of the diaphysis
	T2[1]	4	Supine	Point where the anterior crest crosses over to the medial border of the shaft above the medial malleolus
	T1	5	Supine	Proximal margin of the distal articular surface, at a point opposite the tip of the medial malleolus
	T0	6	Supine	Most distal point of the medial malleolus
Fibula	P0		Supine	Most proximal point of the head
	P1		Supine	Most laterally projecting point on the head, opposite the proximal articulation
	P2[2]		Supine	Nutrient foramen
	P3		Supine	Proximal border of the distal articular facet
	P4		Supine	Most distal point on the lateral malleolus

Figure C. 1: Definitions of bone landmarks used in the estimation of long bone length, with correspondence to landmarks of Steele (1970).
Taken from Taken from Wright and Vásquez (2003)

[1] Landmark is not used in any of the equations listed in Wright and Vásquez's (2003) Table 5. However, it is used in equations listed in their Appendix
[2] Landmark is not used in any of the equations generated and deemed acceptable in the Wright and Vásquez (2003) study.

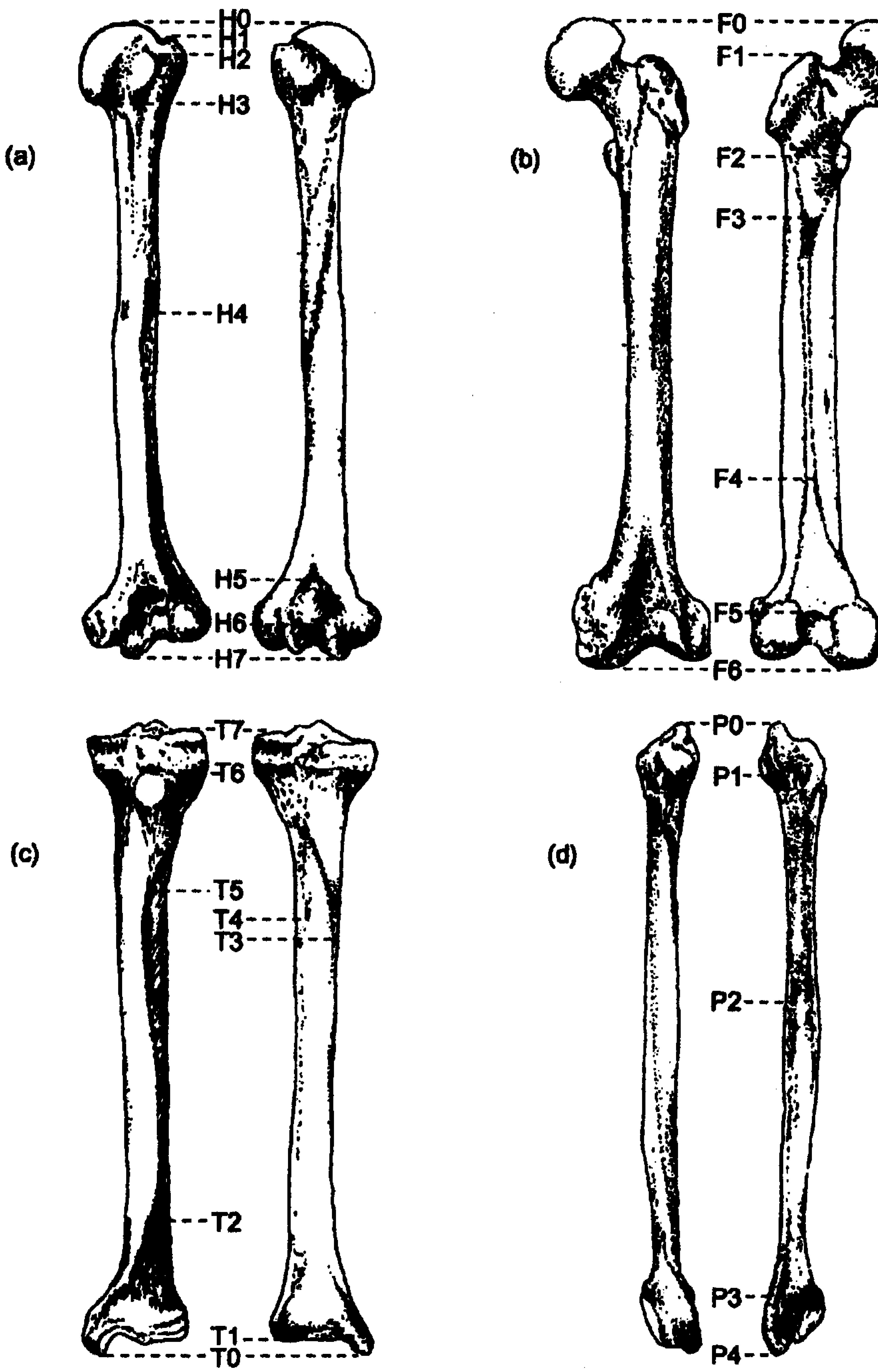

Figure C. 2: Landmarks used to estimate the bone length of the humerus (a), femur (b), tibia (c), and fibula (d). Left bones are illustrated, with the ventral aspect at the left, and the dorsal aspect at the right.

Taken from Wright and Vásquez (2003).

APPENDIX D: NON-METRIC TRAIT DATA

Introduction

The following section discusses the different cranial non-metric traits that were observed in the human skeletal samples recovered from the Marcahuamachuco wall burials of 63H and 63C (see Table D.1 and Table D.2), the remains interred under the Castillo (63Q3) at Marcahuamachuco and the skeletal remains recovered from inside the Mausoleum at Cerro Amaru. The non-metric traits observed here were based on the definitions and localities outlined in both Buikstra and Ubelaker (1994) and Hauser and De Stefano (1989).

D.1 63H

As there were only two relatively complete skulls, a calvaria and a cranium, only two individuals from 63H exhibited cranial non-metric traits. The first was a middle aged male from 63H15 who displayed a mastoid foramen on his right and left temporal, an occipital foramen, as well as an asterionic bone. The second was a juvenile male recovered from 63H17S who exhibited a single parietal foramen on the right and left parietal, a coronal ossicle on the right hand side, and multiple lambdoid ossicles on the left side of the lambdoid suture.

D.2 63C

In contrast, seven different skeletal elements excavated from 63C1 displayed cranial non-metric traits. ID 581, 582 and 649 all had two zygomatico-facial foramina on the left zygomatic, while ID 651 had three on the right hand side. ID 582, a young male, also one left parietal foramen, one left parietal notch bone, multiple lambdoid ossicles, and an asterionic bone on the left side. It is definitely possible that some of the bones that exhibited cranial non-metric traits originated from the same individual.

ID 583, 589 also had one left asterionic bone, though in conjunction with the extra bone ID 583 also displayed one left parietal foramen and multiple left lambdoid ossicles. An asterionic bone was found on the right side of ID 590 and 908, with an extra epipteric bone and mastoid foramen on the right for ID 590 and a single lambdoid ossicle in ID 908. An adult male, ID 591 displayed a single right parietal foramen and a single left

ID	Location #	Bone	Sex/Age Determination	Zygomatico Facial Foramina	Parietal Foramen	Parietal Notch Bone	Mastoid Foramen	Occipital Foramen	Epipteric Bone	Coronal Ossicle	Lambdoid Ossicle	Asterionic Bone
87	63H17S	Cranium	Male/Juvenile		Right & Left/1					Right/1	Left/Multiple	
88	63H15	Calvaria	Male/Middle Adult				Right & Left/1	- /1				Right/1
581	63C1	Maxilla	Unknown/Juvenile-Young Adult	Left/2								
582	63C1	Calvaria	Male/Juvenile-Young Adult	Left/2	Left/1	Left/1	Left/2				- /Multiple	Left/1
583	63C1	Calvaria	Male/Young Adult		Left/1						Left/Multiple	Left/1
589	63C1	Temporal	Female/Unknown									Left/1
590	63C1	Cranium	Female/Juvenile - Young Adult				Right/1		Right/1			Right/1
591	63C1	Calvaria	Male/Adult		Right/1						Left/1	
649	63C1	Zygomatic	Unknown/Unknown	Left/2								
651	63C1	Zygomatic	Unknown/Unknown	Right/3								
744	63C1	Temporal	Unknown/Unknown				Left/1					
908	63C1	Calvaria	Unknown/Unknown								- /1	Right/1

Table D. 1: Cranial non-metric traits recorded in the skeletal samples taken from wall burials.
The location and the number present is recorded for each trait, i.e. side/quantity, where – means not applicable.

Sample Designation	Bone	Quantity of Skeletal Element Observed in Sample (50% or more complete)	Quantity with NMT	Quantity without NMT
63H	Cranium	1	1	0
63H	Calvaria	1	1	0
63C1	Maxilla	4	1	3
63C1	Calvaria	5	4	1
63C1	Temporal	6	2	4
63C1	Cranium	1	1	0
63C1	Zygomatic	3	2	1

Table D. 2: Presence/Absence table of non-metric traits in the skeletal samples taken from wall burials.

lambdoid ossicle. The last individual of unknown age and indeterminate sex had a single mastoid foramen on the left parietal.

D.3 The Castillo at Marcahuamachuco 63Q3

No cranial non-metric traits were observed or recorded for the fetal or adult individuals interred under the Castillo, since a partial fetal sphenoid bone was the only cranial fragment recovered from either the fetal or adult individual.

D.4 The Mausoleum at Cerro Amaru

Only three different cranial non-metric traits were recorded for the mausoleum population (see Table D.3). Right and left parietal foramena were located on the young adult calvaria of ID 208 and the parietals of ID 243. A left mastoid foramen was found on the left temporal of a female of unknown age, ID 176. Two right mental foramena were observed on a middle adult male, ID 178.

ID	Location #	Bone	Sex/Age Determination	Parietal Foramen	Mastoid Foramen	Mental Foramen
176	64A	Temporal	Female/Unknown		Left/1	
178	64A	Mandible	Male/Middle Adult			Right/2
208	64A	Calvaria	Unknown/Young Adult	Right and Left/1		
243	64A	Parietal	Unknown/Unknown	Right and Left/1		

Table D. 3: Cranial non-metric traits recorded in the skeletal samples recovered from within the mausoleum at Cerro Amaru.
The location and the number present is recorded for each trait, i.e. side/quantity, where – means not applicable.

APPENDIX E: SEX DETERMINATION RESULTS FOR MARCAHUMACHUCO WALL BURIALS

Introduction

The following section provides a more detailed analysis of the morphological and metric results of the sex determination for the human skeletal remains taken from the archaeological contexts of 63H and 63C. To better understand the demographics of the structural complex that housed all the remains sampled from 63H, all morphological sex determinations based on skeletal elements recovered from a cut with a 63H designation, have been grouped together.

1. Morphological

Utilizing the morphological differences in the cranium, mandible, os coxae, and humeri, sex was assessed for forty-eight skeletal elements recovered from burials located in wall niches.

- Cranial Morphology

Utilizing the overall robusticity of the cranium, it was determined that one female and six males were represented in the assemblage. Two of the males were recovered from 63H, while one female and four males were excavated from 63C. The sex assessment was based on a combination of the traits, including the nuchal crest, supercilliary arches, rims of the eye orbits, overall robusticity of the cranium and/or the size of the mastoid process. The remaining cranial estimates were assessed using only single skeletal elements.

- Frontal

Due to issues of fragmentation and preservation, sex was determined on the next set of individuals, n = 7, utilizing only the sex characteristics of the frontal bone. In most instances, only the supercilliary arches, or lack thereof, was the basis of the sex determination. All of the seven determinations, two female and five male, were made on remains recovered from 63C. No frontal bones were preserved well enough/present that could provide additional information for 63H.

- Temporal

The temporal was one of the most prevalent bones in the samples, though often only the petrous portion was intact. This was not conducive to morphological analysis of sex. There were however, nine intact mastoid processes recovered from 63C, to provide sufficient evidence for sex determination. As previously mentioned, the ancient Peruvians do not display a lot of sexual dimorphism. This was apparent in the size and robusticity of the mastoid. Very few male determinations would be considered large and robust in other populations, but taken within the context of the collections from Marcahuamachuco and Cerro Amaru, subtle size differentiations were seen, especially in the distension of the mastoid process past the rest of the temporal bone

All four temporals assessed as male were determined to be from the left side of the body, while the female temporals had one right, three left and one which the side could not be determined. This could affect the total number of females in the sample, as it is plausible that one or two sets of the temporals were from the same individual(s)[30]. This could potentially reduce the number of identified females from five to three. In contrast, the male determinations were not affected as much as the females, since of the four male assessments one temporal was right and three were left. Therefore, the possible reduction of the amount of male classifications could only drop from four to three.

- Mandible

Once analyzed, it was evident that a higher proportion of males versus females were assessed using the mandible. Nine individuals were determined to be male, two from 63H and seven from 63C1, while only one was identified as female from 63C1. Overall, an additional ten sex determinations were added to the sample through the mandible.

- Os Coxa

The pelvic bones were not recovered very often in the sample from Marcahuamachuco, with the only morphological diagnostic pieces of the os coxae were recovered from the provenience 63C1. Sex was determined for the os coxae using the size/angle of the sciatic notch. Two right os coxae, were determined to be female. The

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[30] Even if some of the temporals are actually matched pairs, the overall sex assessment does not affect the MNI for 63C, which equals twelve.

remaining five os coxae were determined to be male. As with the temporal bone, siding potentially affects the overall total of male estimations. From this sample, three were from the left side, while two were from the right. Potentially, this could drop the total number of male assessments from five to three, if one or two of the sets of os coxae belonged to the same individual(s).

- Humerus

Overall, the Rogers' (1999) distal humerus method provided an additional eight sex determinations (see Table E.1). As with the other morphological methods, siding can alter the total number of sex estimates. Although the provenience 63H12 is unaffected since only a single female assessment was made, seven estimations were made on humeri recovered from 63C1. Within the humeri from 63C1, six (five right and one left) were assessed as male, while only one was designated female. Siding could potentially reduce the total assessment of male estimates by one. The reduction in the total number is highly probable since two of the humeri, ID 776 and 777, were of similar morphology and robusticity. Also, as will be seen in a later section on stature, the two humeri produced almost identical stature estimations.

It should be noted that five of the male determinations were based on either two (n = 2) or three (n = 3) of the five sex specific traits. The remaining two or three traits the author was unable to determine due to water damage and the fragmentary nature of the skeletal remains. However, all five were assessed by both the shape and depth of the olecranon fossa, which Rogers (1999) noted was the most reliable area. In her study, Rogers (1999) was able to correctly determine the sex of indeterminate cases five out of six times, using only the aforementioned two traits. Rogers (1999) also found that when all five traits were available, accuracy increased from 88.6% to 94% when the olecranon fossa depth and shape were given more weight. Therefore, the olecranon fossa appears to be the most sexually diagnostic portion of the distal humerus.

2. Metric

The methods of metric sex determination were used for the occipital, ulna, femur and tibia, with no regard to laterality. The metric analysis proved very useful on the skeletal elements that were more fragmented and poorly preserved, providing an

ID	Location #	Bone	Side	Trochlear Constriction	Trochlear Symmetry	Olecranon Fossa Shape	Olecranon Fossa Depth	Angle of the Medial Epicondyle	Sex Determination
36	63H 12	Humerus	Right	Female	Male	Female	Female	Undetermined	Female
762	63C 1	Humerus	Right	Undetermined	Undetermined	Male	Male	Undetermined	Male
763	63C 1	Humerus	Right	Undetermined	Undetermined	Male	Male	Male	Male
776	63C 1	Humerus	Right	Undetermined	Undetermined	Male	Male	Undetermined	Male
777	63C 1	Humerus	Left	Undetermined	Undetermined	Male	Male	Undetermined	Male
778	63C 1	Humerus	Right	Undetermined	Undetermined	Male	Male	Undetermined	Male
780	63C 1	Humerus	Right	Female	Female	Female	Female	Female	Female
917	63C 1	Humerus	Right	Male	Male	Male	Male	Male	Male

Table E. 1: Sex determination based on the morphological characteristics of the humerus as outlined in Rogers (1999), for the skeletal elements recovered from wall burials.

additional nine sex determinations for 63H and twenty-three for 63C1.

- Foramen Magnum

The Holland (1986) discriminant function analysis of the foramen magnum resulted in an additional five sex determinations, four of which were from the same provenience (see Table E.2). The four assessments for the context 63C1 were all conducted on incomplete occipital bones, while the foramen magnum was measured on a complete calvaria from 63H15. Three of the individuals fell in the female category, while the other two were determined to be male.

ID	Location #	Bone	Foramen Magnum Length (mm)	Foramen Magnum Breadth (mm)	Discriminant Function Analysis	Sex Determination
88	63H15	Calvaria	29.19	23.58	1.245	Female
569	63C1	Occipital	32.10	27.00	0.907	Female
572	63C1	Occipital	39.53	32.29	0.202	Male
621	63C1	Occipital	37.35	31.15	0.390	Male
622	63C1	Occipital	34.62	28.76	0.669	Female

Table E. 2: Discriminant function analysis of the foramen magnum based on Holland (1986). Individuals with a score on a discriminant function greater than 0.5 are classified as females; those with a score less than 0.5 are classified as males; those with a score equal to 0.5 are unclassified.

Two of the determinations, ID 88 and 569, conflicted with the results from the morphological analysis. The morphological assessment concluded that these two individuals were male, while the discriminant function analysis of their foramen magnum suggested that they were female. To limit potential bias and error from the discriminant function analysis, if a morphological assessment was available, it was given the heavier weight. Subsequently, morphology was used as the definitive sex diagnosis.

- Ulna

The Safont *et al.* (2000) metric equations were used to assess the sex of ulnae (see Table E.3). Four extra female sex determinations were provided for 63C1. Three of the ulnae were from the right side of the body, while one was from the left. There is a possibility that one of the right ulnae could have belonged to the same individual as the left, potentially decreasing the total determinations from four to three individuals. This possibility is highly probable since the minimum circumference of the left ulna falls within a millimetre of two of the right ulnae.

ID	Location #	Bone	Side	Minimum Circumference (mm)	Discriminant Function Analysis	Sex Determination
690	63C 1	Ulna	Right	35	0.295	Female
760	63C 1	Ulna	Right	33	-0.471	Female
783	63C 1	Ulna	Left	34	-0.088	Female
804	63C 1	Ulna	Right	30	-1.620	Female

Table E. 3: Discriminant function analysis of ulnas recovered from wall burials based on Safont *et al.* (2000).
Individuals with a score on a discriminant function greater than 0.415 are classified as males; those with a score less than 0.415 are classified as females; those with a score equal to 0.415 are unclassified.

Although the accuracy ranged from 75.9 to 83.3% in Safont *et al.* (2000) test samples and 91.1% in the original population, it should be noted that according to their research, the ulna is the least reliable long bone to determine sex, due to the small amount of sexual dimorphism between males and females.

- Femur

Three different methods of metric analysis were used to provide additional sex determinations of femora. The first two methods, outlined by Safont *et al.* (2000) and Black III (1978), used the midshaft circumference (see Table E.4). From 63H12, a right and left femur were assessed as female. It is not likely that the two femora belonged to the same individual, since the actual measurement of the femoral shafts differed by 4.5mm.

From 63H17S, a right and two left femora were assessed for sex, using the Black III (1978) and Safont *et al.* (2000) methods. One left, ID 116 was determined to belong to a male, while the other two femora were assessed as female. Analyzing the femora by side revealed that the closest midshaft femoral measurement to the right side, differed by 3mm, ID 117 and 119 respectively. The difference is likely due to the fact none of the bones were from the same individual.

Six sex determinations were performed on femora recovered from the 63C1 provenience. In total, two rights and four lefts were assessed. The Safont *et al.* (2000) functions provided all female determinations. In contrast, Black III (1978) method resulted in four female, one male and one indeterminate sex assessment. The two discrepancies occurred on ID 791 and ID 794. These two cases are extremely close to, or on, the Black III (1978) sectioning point. This makes it plausible that both bones are from the same individual, since one is a left and the other is a right and their circumferences differ by only 1.0 mm. Also, the only other right femur has a potential mate, which differs in the measurement of the circumference from ID 793 by only 1.0 mm. Of the six sex determinations, potentially two may be femora belonging to the same individual(s).

The discriminant functions of Trancho *et al.* (1997) were used to provide less controversial and subjective sex determinations of the femur, since the method was based on more standardized measurements. An additional eleven sex assessments were provided, with all but three overlapping IDs with the Black III (1978) and Safont *et al.* (2000) metric methods (see Table E.5). From 63H12, the Trancho *et al.* (1997) method provided two female assessments. This result corroborates the findings in the previous analysis utilizing the discriminant functions of Black III (1978) and Safont *et al.* (2000). However, when observing the difference between the measurements of the actual femur, it becomes apparent that the two bones likely belonged to two individuals, especially if observing the transverse subtrochanteric diameter.

The next femur analyzed through Trancho *et al.* (1997) functions, was recovered from 63H17S. The metric method produced an indeterminate result. When comparing the transverse subtrochanteric diameter measurement of ID 116 to the others, it is clear that the value is largest in the group. The larger measurement, coupled with the male assessments obtained from the Black III (1978) and Safont *et al.* (2000) metric methods, makes it probable that ID 116 actually belonged to a male individual.

In conjunction with the six sex determinations based on the midshaft circumference, two more sex determinations for 63C1 were provided by the discriminant functions taken from Trancho *et al.* (1997). Two inconsistencies occurred between the Trancho *et al.* (1997), Safont *et al.* (2000) and Black III (1978) metric sex determinations. The first was ID 791, in which the Trancho *et al.* (1997) and Black III (1978) metric analyses suggested the femur was from a male individual, while the Safont *et al.* (2000) function indicated that the individual was female. In contrast, ID 794's female assessment was in agreement with the Safont *et al.* (2000) result, while the Black III (1978) methodology provided indeterminate sex. In these instances, the majority or 2/3 were chosen as the definitive sex determination.

ID	Location #	Bone	Side	Midshaft Circum. (mm)	Discrim. Function Analysis (Black 1978)	Sex Determination (Sectioning Point = 0.0)	Discrim. Function Analysis (Safont *et al.* 2000)	Sex Determination (Sectioning Point = 0.182)
2	63H 12	Femur	Left	70	-11	Female	-2.450	Female
14	63H 12	Femur	Right	74.5	-6.5	Female	-1.600	Female
116	63H 17S	Femur	Left	84	3	Male	0.196	Male
117	63H 17S	Femur	Right	73	-8	Female	-1.883	Female
119	63H 17S	Femur	Left	77	-4	Female	-1.127	Female
789	63C 1	Femur	Left	67	-14	Female	-3.017	Female
791	63C 1	Femur	Right	82	1	Male	-0.182	Female
792	63C 1	Femur	Left	78	-3	Female	-0.938	Female
793	63C 1	Femur	Left	70	-11	Female	-2.450	Female
794	63C 1	Femur	Left	81	0	Indeterminate	-0.371	Female
914	63C 1	Femur	Right	69	-12	Female	-2.639	Female

Table E. 4: Discriminant function analysis of femora recovered from wall burials based on Black III (1978) and Safont *et al.* (2000). Individuals with a score on a discriminant function greater than 0.0/0.182 are classified as males; those with a score less than 0.0/ 0.182 are classified as females; those with a score equal to 0.0/0.182 are unclassified.

ID	Location #	Bone	Side	Bi-condylar Length (mm)	Max Head Diameter (mm)	Sagittal Sub-trochanteric Diameter (mm)	Transverse Sub-trochanteric Diameter (mm)	Discrim. Function Analysis	Sex Determination
2	63H 12	Femur	Left	55.90		20.76	26.12	-7.247	Female
14	63H 12	Femur	Right			21.39	22.64	-3.161	Female
116	63H 17S	Femur	Left			23.62	32.88	-0.055	Indeterminate[31]
789	63C 1	Femur	Left	62.00		17.47	24.24	-5.590	Female
790	63C 1	Femur	Right			23.45	29.36	-0.891	Female
791	63C 1	Femur	Right	79.00	39.60	25.35	30.39	0.338	Male
792	63C 1	Femur	Left			23.01	28.86	-1.171	Female
793	63C 1	Femur	Left			16.62	23.50	-4.829	Female
794	63C 1	Femur	Left	74.00	40.79	23.86	30.30	-0.944	Female
821	63C 1	Femur	Unknown		39.53			-1.846	Female
914	63C 1	Femur	Right	61.00		18.78	21.74	-5.770	Female

Table E. 5: Discriminant function analysis of femora recovered from wall burials based on Trancho *et al.* (1997). Individuals with a score on a discriminant function greater than 0.0 are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

[31] Although Trancho *et al.* (1997) do not provide an indeterminate value; the sex has been classified as indeterminate due to its proximity to the sectioning point.

As with all other methods that use bones which can potentially be paired, siding was a factor in this final batch of sex determinations based on femoral measurements from skeletal elements recovered from 63C1. Of the eight estimations, four were conducted on lefts, three were right femora and one was unknown. Clearly, with so much similarity between the measurements, it remains highly plausible that of the eight estimations, up to four of the femora could be paired. This would potentially greatly reduce the true number of sex determinations.

- Tibia

Since long bones are more frequently represented in fragmented and/or commingled contexts, metric methods that use measurements of the tibia were included in the determination of sex. Based on the discriminant functions created by Safont *et al.* (2000), the first measurement used was the circumference of the tibia at the nutrient foramen, which is credited as the most dimorphic variable. An additional three sex determinations were added to the analysis for 63H and seven from 63C1 (see Table E.6).

Of the ten determinations taken from the sampling of wall burials, one right and one left assessment was made from the 63H12 provenience. While the measurements indicated that the tibiae belonged to females, the actual circumference of the tibia differed by 3mm; 77 and 74mm respectively. Although, it is possible that within one individual, bilateral asymmetry between the circumferences of the long bones can occur, it is more likely that the two tibiae belonged to two separate individuals.

ID	Location #	Bone	Side	Circumference at the NF (mm)	Discriminant Function Analysis	Sex Determination
1	63H 12	Tibia	Left	77	-1.772	Female
12	63H 12	Tibia	Right	74	-2.354	Female
115	63H 17S	Tibia	Left	86	-0.026	Female
795	63C 1	Tibia	Right	79	-1.384	Female
796	63C 1	Tibia	Right	90	0.750	Male
797	63C 1	Tibia	Right	86	-0.026	Female
798	63C 1	Tibia	Left	83	-0.608	Female
799	63C 1	Tibia	Left	73	-2.548	Female
800	63C 1	Tibia	Left	85	-0.220	Female
909	63C 1	Tibia	Left	81	-0.996	Female

Table E. 6: Discriminant function analysis of the tibias recovered from wall burials based on Safont *et al.* (2000).
Individuals with a score on a discriminant function greater than 0.252 are classified as males; those with a score less than 0.252 are classified as females; those with a score equal to 0.252 are unclassified.

The next sex determination was made on a left tibia from 63H17S. The tibia was more robust than the other two tibiae from 63H12, with a circumference of 86mm. Nonetheless, even with the difference in robusticity, as with the two aforementioned sex determinations, the 63H17S tibia was assessed as a female.

From within the sample of 63C1, sex was estimated for three right and four left tibiae. With the exception of ID 796, all sex determinations were female. The difference in the circumference at the nutrient foramen for the male specimen is only 4mm from the nearest female measurement, or 90mm comparable to 86mm. Although the side can play a role in determining the exact amount of individuals present, two tibiae, one left and one right, likely do not have an opposite counterpart. The left tibia has a circumference 6 mm smaller than the nearest right tibia, while the only male observation is 4 mm larger than the nearest female. Therefore, it is probable that the male right tibia and the female left tibia are two distinct individuals within the context of 63C1. It does however remain plausible that ID 795 or ID 797, right tibiae identified as females do have left counterparts, since both are only 2mm and 1mm respectively from the nearest circumference measurement of the lefts. Since there is the probability of joining two of the right tibiae with a partner on the left hand side the total number of sex determinations from 63C1 could drop from seven to five.

The González-Reimers *et al.* (2000) metric equation, which required the transverse diameter at the nutrient foramen, provided eleven female sex assessments and one male sex estimation (see Table E.7). As already discussed, a problem with siding arises in the 63H12 and 63C1 contexts with the possibility that ID 12, 795 and 797 have left counterparts within the sample due to their similarity in measurements. The González-Reimers *et al.* (2000) method was created on a "Black" African population, which is notorious for being more robust than "White" European, Asian and consequently Peruvian populations (Byers 2002; White 2000; Bass 1995). Therefore, it is highly probable that robusticity or lack thereof, played a significant role in the sex determinations based on the González-Reimers *et al.* (2000) metric equations.

ID	Location #	Bone	Side	Transverse Diameter at NF (mm)	Discrim. Function Analysis	Sex Determination
1	63H 12	Tibia	Left	19.56	-6.081	Female
12	63H 12	Tibia	Right	19.08	-6.977	Female
115	63H 17S	Tibia	Left	21.51	-2.442	Female
795	63C 1	Tibia	Right	21.37	-2.834	Female
796	63C 1	Tibia	Right	26.62	-5.857	Female
797	63C 1	Tibia	Right	22.34	-2.704	Female
798	63C 1	Tibia	Left	21.32	7.093	Male
799	63C 1	Tibia	Left	17.31	-0.894	Female
800	63C 1	Tibia	Left	21.19	-2.797	Female
909	63C 1	Tibia	Left	20	-10.280	Female

Table E. 7: Discriminant function analysis of the tibia based on González-Reimers *et al.* (2000). Individuals with a score on a discriminant function greater than 0.0 are classified as males; those with a score less than 0.0 are classified as females; those with a score equal to 0.0 are unclassified.

APPENDIX F: INVENTORY OF HUMAN ADULT SKELETAL REMAINS FROM 63Q3

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number MARCAHUAMACHUCO / 63 Observer SPIGELSKI

Feature/Burial Number CASTILLO / Q3 Date 2006

Burial/Skeleton Number —— / BAG 55 and 59

Present Location of Collection HUAMACHUCO, PERU

CRANIAL BONES AND JOINT SURFACES

	L(left)	R(right)		L	R
Frontal	–	–	Sphenoid	–	–
Parietal	–	–	Zygomatic	–	–
Occipital	–	–	Maxilla	–	–
Temporal	–	–	Palatine	–	–
TMJ	–	–	Mandible	–	–

POSTCRANIAL BONES AND JOINT SURFACES

	L	R		L	R
Clavicle	–	X (0-24 / complete)	Os Coxae		
Scapula			Ilium	X	X
Body	–	–	Ischium	X	X
Glenoid f.	X	X	Pubis	X	X
Patella	X	–	Acetabulum	X	X
Sacrum	X	X 25-49 / complete	Auric. Surface	X	X

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	–	–
C2	X	X
C7	–	–
T10	–	–
T11	–	–
T12	–	–
L1	X	–
L2	X	–
L3	X	–
L4	X	X
L5	X	–

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	– / –	– / –
* T1-T9	3 / 1	2 / 1

Sternum: Manubrium X Body –

RIBS (individual)

	L	R
1st	–	–
2nd	–	–
11th	–	–
12th	–	–

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	– / –	– / –	– / –

Series/Burial/Skeleton 63 Q3 55 and 59
Observer/Date SPIGELSKI 06

LONG BONES

	Proximal Epiphysis	Diaphysis Proximal Third	Diaphysis Middle Third	Diaphysis Distal Third	Distal Epiphysis
Left Humerus	x	–	x	x	x
Right Humerus	x	–	x	x	–
Left Radius	–	–	–	–	–
Right Radius	–	–	–	–	x
Left Ulna	x	–	–	–	–
Right Ulna	–	–	–	–	x
Left Femur	–	x	x	–	–
Right Femur	x	x	x	x	x
Left Tibia	–	x	x	x	x
Right Tibia	–	x	x	x	–
Left Fibula	–	x	x	x	x
Right Fibula	–	x	x	x	–

Left Talus –
Right Talus x
Left Calcaneus x (0-24% complete)
Right Calcaneus x (25-49% complete)

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	–/–	–/–	–/–
#Metacarpals	4/1	3/1	–/–
#Phalanges	–/–	1/1	–/–

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	1/1	–/–	–/–
#Metatarsals	–/–	4/2	–/–
#Phalanges	–/–	–/–	1/1

Comments: The following observations were made
- no cranial fragments were recovered
- The os coxae were in 11 fragments, which could not be pieced back together (2 id'd as L and 4 id'd as R)
- Unsure of exact position/# of thoracic vertebrae
- In regards to lumbar vertebrae - mostly bodies. One is possibly not a vertebral body (fragmented and hard to ID)
- No ribs were recovered

LEGEND
x = present
– = n/a or Absent

Adult inventory from 63 Q3, the remains recovered from underneath the Castillo, Marcahuamachuco. Modified from Buikstra and Ubelaker (1994).

APPENDIX G: INVENTORY OF HUMAN SKELETAL REMAINS FROM 63Q3

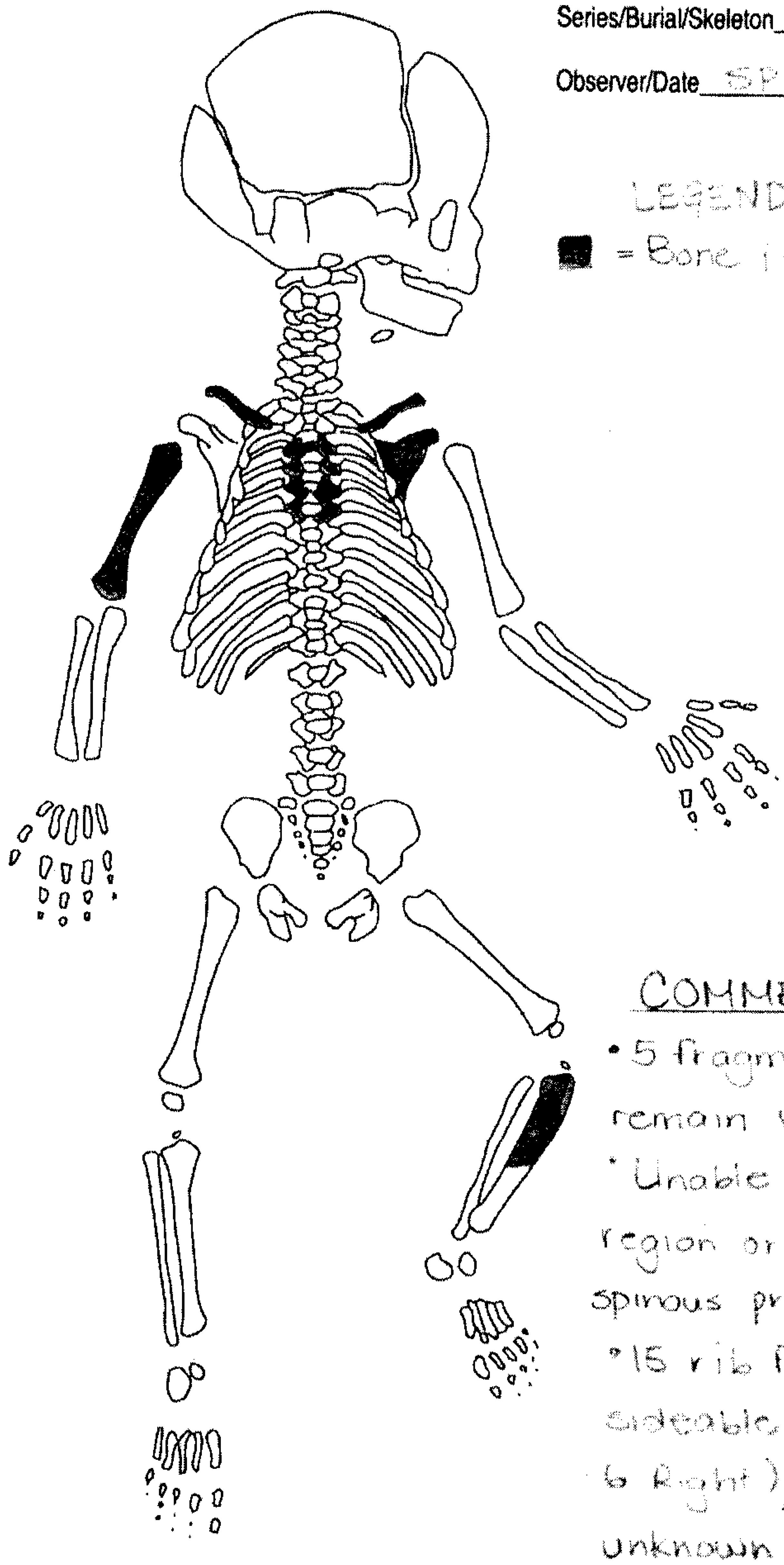
JUVENILE SKELETON VISUAL RECORDING FORM
b. FETUS (NEWBORN), ANTERIOR VIEW

Series/Burial/Skeleton 63 Q3-55

Observer/Date SPIGELSKI '06

LEGEND

■ = Bone is present



COMMENTS:

- 5 fragments of bone remain unidentified
- Unable to determine region or position of spinous processes/body
- 15 rib fragments were sideable (9 Left and 6 Right), but position unknown
- 17 unidentifiable rib fragments
- Sphenoid is present.

Fetal inventory recording form from 63 Q3, recovered from underneath the Castillo, Marcahuamachuco. Modified from Buikstra and Ubelaker (1994).