1-1-2017

Death in the Gobi: a Case Study of Skeletal Trauma from the Hets Mountain Cave in Mongolia

Christina Marie Ramazani

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By

Christina Ramazani

A Thesis
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Master of Arts
in Applied Anthropology
in the Department of Anthropology and Middle Eastern Cultures

Mississippi State, Mississippi

May 2017

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By

Christina Ramazani

Approved:

Molly K. Zuckerman
(Major Professor)

Michael L. Galaty
(Committee Member)

Bruno Frohlich
(Committee Member)

Nicholas P. Herrmann
(Committee Member)

Evan Peacock
(Graduate Coordinator)

Rick Travis
Interim Dean
College of Arts & Sciences

Name: Christina Ramazani

Date of Degree: May 6, 2017

Institution: Mississippi State University

Major Field: Applied Anthropology

Major Professor: Molly K. Zuckerman

Title of Study: Death in the Gobi: A case study of skeletal trauma from the Hets Mountain Cave in Mongolia

Pages in Study: 100

Candidate for Degree of Master of Arts

This study represents a contextualized analysis of the perimortem trauma and postmortem treatment of an assemblage (n=9) of naturally mummified individuals recovered from the Hets Mountain Cave in southern Mongolia. The assemblage dates AD 1434-1651, a period characterized by political instability and widespread conflict. Analysis of the trauma was completed utilizing radiological evaluation of 3D CT data. The perimortem trauma and postmortem treatment are contextualized within documentary and archaeological data on contemporary Mongolian mortuary and cultural practices to understand the social identities of these individuals. The trauma patterns are consistent with execution methods reserved for higher status Mongolians; the mortuary treatment is suggestive of a hybrid of Shamanistic and Lamaistic mortuary practices reserved for higher status Mongolians. These findings speak to the utility of case-study based analyses in complementing more top-down historical studies for understanding the effects of political instability and widespread conflict upon individuals during poorly documented time periods.

DEDICATION

This thesis is dedicated to all of my friends and family who have loved and supported me through this process and beyond. Ramy, Regina, Gabrielle, Whitney, Katie, Christopher, Adelaide, Kahlin, and last but not least, Anna Maria Pack and Kyle Pack, who will not see me walk but walk with me always.

ACKNOWLEDGEMENTS

I thank my committee, Dr. Molly Zuckerman, Dr. Bruno Frohlich, Dr. Mike Galaty, and Dr. Nicholas Herrmann, for their invaluable guidance and advice throughout this process. I thank the Smithsonian Institution National Museum of Natural History and the Mongolian Academy of Sciences for allowing me to use their CT data for this thesis. I thank Dr. Eric Lawson and Dr. Russell Allman for volunteering their time and expertise to provide consults on my findings. I thank the faculty and staff in the Mississippi State University's Department of Anthropology and Middle Eastern Cultures for providing me with endless moral support and an education that I will always value. I specially thank Mississippi State University's Center for Distance Education and Department of Biological Sciences for providing me the necessary funds to cover my tuition and giving me an excellent and inspiring work experience. It is with these individuals and entities that this thesis was made possible.

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CHAPTER I

INTRODUCTION

The investigation of interpersonal violence has become a vigorous area of scholarship in bioarchaeology and paleopathology over the past three decades (Martin & Harrod, 2015). For the purposes of this study, skeletal evidence of interpersonal violence is defined as being compatible with "skeletal injuries for which there is strong circumstantial evidence of malevolent intent," where malevolent intent is the intent to harm or kill (Walker, 2001:576). According to Perez (2012:14), violence is a "complex expression of cultural performance" and therefore acts of violence have cultural meaning. In turn, interpretation of these meanings through identification of the ante- and perimortem trauma and post-mortem treatment of skeletal remains can grant insights into the social identity of the victims of violence and, potentially, reasons why they were subject to violence. Among others, Perez (2012) has introduced a theoretical framework, the "politicization of the dead", for interpreting skeletal evidence of trauma that is attributable to politically and socioculturally motivated violence, specifically violence that is justified by cultural norms. In this model, ante- and perimortem trauma and post-mortem treatment are viewed as symbolic, not only for the perpetrators but also for the affected individual or individuals' community; the violence done to the body emphasizes the subjugation of the conquered and the power and dominance of the conquerors.

Here, I apply this framework to the analysis of an assemblage (n=9) of naturally mummified individuals recovered from the Hets Mountain Cave (HMC) of the Southern Gobi Desert in Mongolia (Figure 1). The assemblage includes six sub-adults and three adults, all of whom have previously been reported as exhibiting macroscopic evidence of perimortem trauma consistent with strangulation, hanging or application of traumatic forces to the neck; several individuals were recovered with garroting cords *in situ* (Frohlich et al., 2008). Three of the individuals were dated by accelerator mass spectrometry (AMS) radiocarbon dating to cal. yr. AD 1434 to 1651 (Frohlich et al., 2008). This overlaps with the Ming (AD 1368-1644) and early Quing Dynasties (AD 1644-1911), and post-dates the collapse of the Great Mongolian Empire (AD 1368), also known as the Yüan Dynasty (Frohlich et al., 2008). This period was characterized by a dramatic increase in warfare between Mongolian groups, as well as by drought and famine (Bold, 1999; Mote, 1999). Despite this, the individuals in the assemblage exhibit little to no evidence of being exposed to stress, such as oral pathology, skeletal stress indicators, nutritional stress, or healed fractures and other evidence of trauma, the latter of which would be suggestive of antemortem participation in violent conflict (Frohlich et al., 2008; Turner et al., 2012). This indicates that they may have been buffered in some way from the contemporary turmoil.

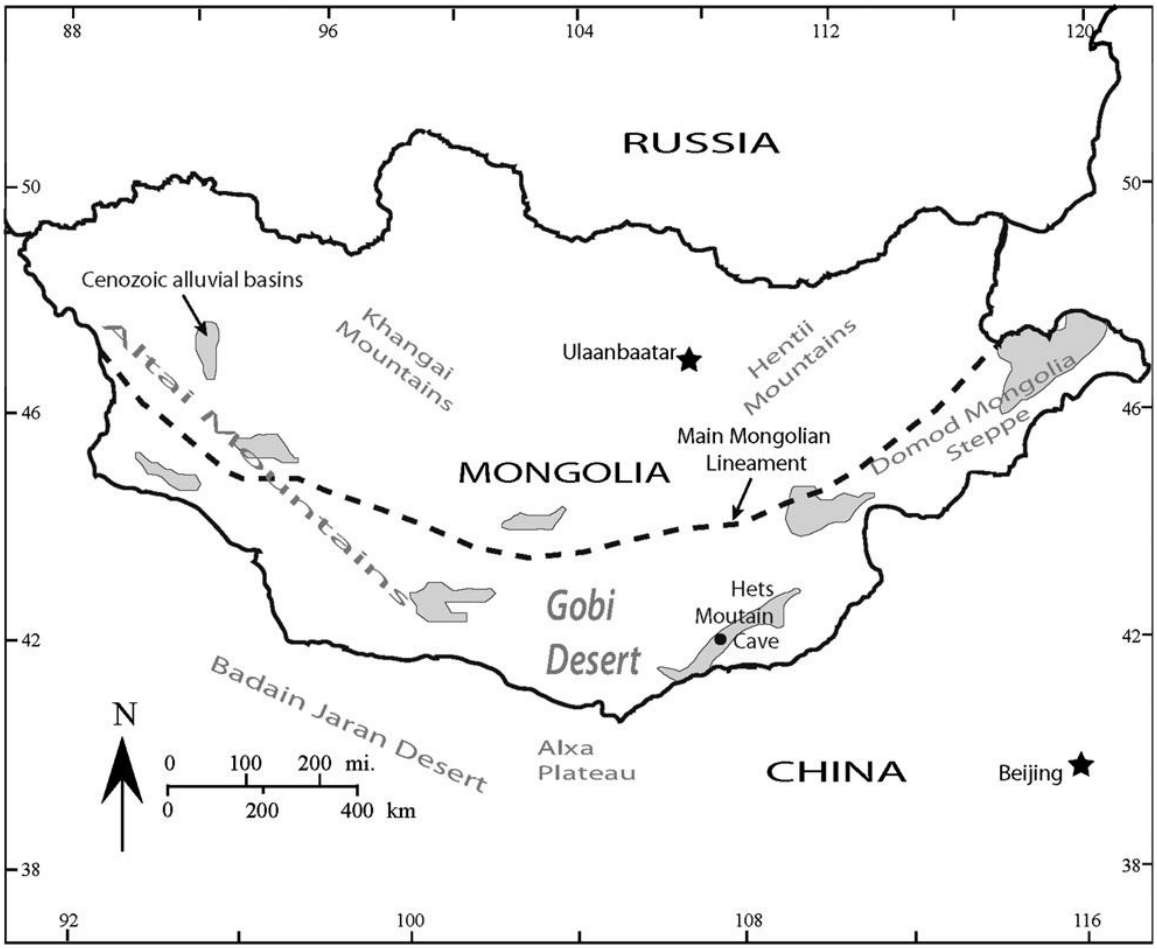

Figure 1 Map of the cave site situated within Mongolia from Turner et al. (2012).

A review of the limited published bioarchaeological literature on Mongolia suggests that this assemblage is the first documented from this period and area to exhibit these distinctive patterns and types of perimortem trauma and that it is unique in its two-stage mortuary treatment; the individuals underwent primary deposition on the surface, featuring extended exposure to the elements, followed by secondary deposition within the Hets Mountain Cave. The assemblage has been the subject of a larger effort by researchers at Mississippi State University, Georgia State University, the Smithsonian

Institution, and the Mongolian Academy of Sciences that aims to address the social identity of these individuals, what circumstances buffered them from contemporary conflict and turmoil, why they were violently killed, and explain their distinctive mortuary treatment. This larger research project is also significant because the assemblage provides some of the first bioarchaeological data for the poorly documented Late Medieval period in southern Mongolia.

Problem Statement

Here, I analyze whole body computer tomography (CT) scans of the individuals in order to comprehensively identify and characterize skeletal evidence of trauma. The scans were also interpreted in relation to the mortuary context of the assemblage in order to better understand the events surrounding the death and deposition of the individuals. This evidence was embedded within ethnographic and historic evidence on traditional Mongolian pastoralist cultures and historical evidence on Late Medieval Mongolia, which additionally aided in navigating issues of equifinality. The results were interpreted within Perez's (2012) framework in order to gain greater insight into the cultural customs and ideologies that may have motivated the perimortem violence, perimortem trauma, and postmortem treatment experienced by the assemblage.

I specifically aimed to determine if the perimortem skeletal trauma and postmortem treatment evident in the assemblage are consistent with combat-related violence—such as raiding or warfare—that occurred at or near the time of death or more performative, punitive violence, as described by secondary historical sources from late Medieval Mongolia. The overarching research question is: what was the social identity of the HMC mummies, and what was their social position within contemporary Mongolian

society? Three secondary questions are also addressed: 1) do the individuals in the assemblage represent an antemortem group, killed at the same time and in the same way or do they exhibit varying patterns of perimortem trauma, suggesting that they were killed in different ways in different contexts or for different reasons? 2) Were the HMC individuals victims of combat-related violence, specifically opportunistic raiding or formal large-scale violence, specifically warfare, or more punitive, ritualistic violence? And finally, 3) why did they experience the distinctive two-step mortuary treatment?

I conducted an analysis of skeletal evidence for ante- and perimortem trauma evident on the skeletons from the Hets Mountain Cave using full body computer tomography (CT) scans. The CT scans were assessed using 3D CT rendering freeware, Horos. I also consulted with radiologists on the identification and interpretation of any skeletal trauma. The results of my analysis were interpreted in relation to secondary historical sources (translated from Chinese and Mongolian to English) pertaining to combat-related and punitive practices, as well as religious practices in Late Medieval Mongolia. My interpretation of the findings also incorporates results from previous studies on the HMC individuals (i.e. Frohlich et al., 2008; Frohlich et al., 2005; Turner et al., 2012; Bazarsad et al., 2005). The integrated interpretation of patterns of skeletal trauma and historical evidence allows estimation of the culturally-specific customs and ideologies motivating and underlying the perimoretem trauma and postmortem and mortuary treatment exhibited by the individuals, shedding light on their social identities, and contributing to our understanding of a poorly documented time period in the hinterlands of Mongolia.

Research Design

H_1: Patterns of perimortem trauma are consistent across all individuals and their injuries occurred approximately at the same time.

Previous analyses have treated the HMC assemblage as an antemortem group of individuals that shared peri- and postmortem experiences of trauma and primary and secondary deposition (Frohlich et al., 2008; Turner et al., 2012). Previous reconstructions of postmortem events indicate that all of the individuals were killed outside of the Hets Mountain Cave, were left exposed until desiccated for approximately the same amount of time, and were secondarily deposited in the cave together (Frohlich et al., 2008). This hypothesis formally assesses whether the perimortem trauma evident on the HMC assemblage in fact represents a temporally isolated episode during which the violence was inflicted and the trauma experienced. I accomplish this through my characterization of traumatic injury via CT data and combining my findings with previously reported macroscopic data. Results consistent with this would include all of the HMC individuals exhibiting similar patterns of sharp force trauma consistent with the use of bladed or projectile weaponry, or all of the HMC individuals exhibiting similar patterns of blunt and sharp force trauma consistent with beating or methods of execution that do not draw blood. Results inconsistent with this hypothesis would include variation in the pattern of perimortem trauma between individuals. For instance, some individuals would exhibit exclusively sharp force trauma from bladed weapons while others would exhibit exclusively blunt force trauma. Variation in trauma at the time of death may suggest that some of the individuals in the assemblage were killed in different contexts, for different reasons or are of different social status, and possibly that they were killed at different

times, though the latter would be difficult to determine if there is no evidence of antemortem healing.

H_2: The patterns of trauma evident in the HMCs are consistent with patterns of violence documented in the historical record.

This hypothesis posits that the trauma evident on the HMC individuals is consistent with documented modes of interpersonal violence within the context of Late Medieval Mongolia. The hypothesis is framed within Perez's (2012) approach, the politicization of the dead. Historical sources suggest that three forms of violence were commonly practiced in Late Medieval Mongolia: opportunistic raiding, large-scale warfare, and punitive, ritualistic killing. Because the trauma that these first two categories produce is likely indistinguishable on the skeleton, raiding and warfare are combined into a single analytical category, combat-related violence. Both of the forms of violence, combat-related violence and punitive ritualistic killing, should generate specific patterns of trauma, which are explored below in H_2a and H_2b.

H_2a: Individuals in the assemblage display types of trauma consistent with those documented in historical sources for combat-related violence, such as opportunistic raiding and formal warfare.

Raiding and warfare in Mongolia were characterized by the use of bladed and projectile weaponry, such as scimitars, spears, and arrows, which produced distinctive patterns of sharp-force trauma. This hypothesis is assessed through comparison of evidence of trauma from the CT scans of the HMC assemblage to patterns of combat-related violence as described in the *Secret History of the Mongols*. This is a Mongolian literary work which provides an account of the reign of Genghis Khan, while also describing the daily life and ideology of Mongols during the Late Medieval period,

including many descriptions of conflict and methods of violence (de Rachewiltz, 2006; Drobyshev, 2008). Results consistent with combat-related violence would include traumatic sharp-force injuries, specifically penetrating fractures, consistent with projectile and blade weaponry. Results inconsistent with combat would include an absence of evidence of sharp-force trauma consistent with projectile or blade weaponry. The presence of trauma injuries on the HMC individuals consistent with combat-related violence would suggest that some or all of the individuals were involved in warfare or were victims of raiding.

H_2b: Individuals in the assemblage display types of trauma consistent with those documented in historical sources for punitive, ritualistic violence.

The *Secret History of the Mongols* describes various methods of execution, some of which were reserved for higher-status individuals, such as individuals of political or social import and human sacrifices (de Rachewiltz, 2006; Drobyshev, 2006). These methods included execution without drawing blood, such as back-breaking, wherein individuals are killed by having a rod, bar, or similar object placed posteriorly against the spine and then having the head or body forced backwards; trampling by horses—often with the individual to be executed rolled within a rug or similar textile prior to trampling; and garroting. This hypothesis seeks to test for the presence of bloodless methods of execution, such as the practice of back-breaking, to the perimortem trauma, as originally suggested by Frohlich and colleagues (2013). This hypothesis is assessed through investigating methods of execution of individuals with differing status as documented in the historical record, and comparing these practices to the patterns of trauma evident on the HMC individuals, as identified via interpretation of the CT scan data. Results

consistent with bloodless methods of execution would include the absence of sharp-force trauma consistent with blades, and the presence of blunt-force trauma. Results inconsistent with bloodless methods of execution would include perimortem dismemberment and sharp-force trauma consistent with the use of blades and projectile weapons. Execution of the HMC individuals using bloodless methods, such as back-breaking, trampling by horses, or strangulation, may suggest that the individuals were of high social status.

H_3: Postmortem/mortuary treatment of the HMC assemblage is consistent with documented contemporary Mongolian mortuary practices.

This hypothesis posits that the postmortem treatment of the HMC individuals aligns with documented mortuary practices in Medieval Mongolia. Primary and secondary historical sources suggest that the two dominant religions in Medieval Mongolia, Shamanism and Lamaism, involved distinct burial practices, and that they also produced a hybridized third practice that combined the funerary treatments of the two religions (de Rachewiltz, 2006; Drobyshev, 2008). Each of the three forms of mortuary treatment are explored in H_3a, H_3b, and H_3c. This hypothesis is assessed through reevaluation of the postmortem treatment of the individuals against historical evidence on mortuary practices in Late Medieval Mongolia.

H_3a: The mortuary treatment is consistent with Shamanistic funerary practices as documented in the historical record.

This hypothesis posits that the secondary deposition of the assemblage in the Hets Mountain Cave is consistent with Mongolian Shamanistic funerary practices. Shamanistic mortuary practices were varied, but burial and cremation were the two predominant

postmortem treatments, while secondary deposition was not unusual (Crubezy et al., 2006; Drobyshev, 2008). Some individuals were deposited in caves and on mountains or other areas of high elevation: this practice was traditionally reserved for high status individuals (Drobyshev, 2008). Shamanistic burials often included grave goods and sacrifices, which were mostly animal but sometimes human. Also, postmortem treatment following the Shamanistic tradition did not include exposure of the body to scavenging and the elements (Drobyshev, 2008). This hypothesis is assessed through reevaluation of the postmortem treatment of the HMC individuals against primary and secondary sources on Shamanistic funerary practices. This assessment specifically examines any evidence of secondary burial, of burial in an elevated place, of scavenging and exposure, of grave goods, and of evidence of animal or human sacrifices. Results consistent with this hypothesis would include the presence of grave goods, animal or human sacrifices, and evidence of secondary burial in an elevated place. Results inconsistent with this hypothesis would include evidence of exposure and scavenging by birds, lack of grave goods and sacrifices, and evidence that the remains were never buried. Inconsistent results that include exposure may suggest alternative methods of treatment, such as those used in Lamaism, or purposeful violation of the remains through abandonment and exposure. The absence of grave goods may suggest Lamaism's influence on the individual's postmortem treatment. However, it may also indicate that the individuals were of low status, or it may be the result of looting that occurred at some point after the deposition of the assemblage. Burial in an elevated location with grave goods and sacrifices may suggest that the HMC individuals—or those responsible for their burial—practiced Shamanism.

H_3b: The mortuary treatment is consistent with Lamaistic funerary practices as documented in the historical record.

Secondary literature suggests that Lamaism became the dominant religion in the 16th and 17th centuries in Mongolia (Hesse 1987; Heissig, 1953; Drobyshev, 2008). Individuals and groups practicing this religion engaged in a funerary treatment referred to as "sky burial", in which the body is left exposed to the elements, including predators, as a final act of altruism. Lamaist funerary practices also typically excluded the use of grave goods (Drobshev, 2008). This hypothesis is tested by evaluating the postmortem treatment of the HMC individuals for any evidence of scavenging by birds as well as the inclusion of grave goods. Results consistent with this hypothesis include evidence of bird scavenging, lack of grave goods and lack of evidence of burial. Results inconsistent with this would include evidence of grave goods and sacrifices and a lack of evidence of exposure and scavenging by birds. Evidence consistent with Lamaistic funerary practices may not be distinguishable from evidence indicative of the Shamanistic practice of violating an individual's remains through abandonment and exposure to scavenging. Exposure to the elements during a single depositional event may suggest treatment compatible with Lamaistic funerary practices or an intentional violation of an individual's remains following a Shamanistic worldview. Evidence of sky burial would suggest that the individuals—or those who were responsible for their burial— were of those who converted to Lamaism.

H_3c: The mortuary treatment is consistent with a hybrid combination of Shamanistic and Lamaistic mortuary practices as documented in the historical record.

Secondary sources suggest that some Shamanistic burial practices, specifically the secondary deposition of a corpse in an elevated place, persisted after the rise of Lamaism in the 16th and 17th centuries in Mongolia and were incorporated into Lamaistic funerary practices (Drobyshev, 2008; Hesse, 1987). This hypothesis is evaluated in relation to the recorded presence of grave goods and sacrifices, evidence pertaining to exposure, scavenging, and secondary deposition. Results consistent with this hypothesis would include evidence of secondary burial, secondary or primary burial in an elevated place, as well as of exposure and scavenging. Results inconsistent with this hypothesis would include suites of evidence exclusively consistent with Shamanistic burials, as described in H_3a or suites of evidence exclusively consistent with a Lamaistic treatment, as described by H_3b. Results consistent with this hypothesis would suggest that the postmortem treatment of the HMC individuals likely reflects a persistence of Shamanistic practices in an increasingly Lamaistic time and place. The combination of Shamanistic and Lamaistic practices may suggest that the HMC individuals—or those responsible for their burial—had converted to Lamaism, but still continued some Shamanistic practices in secret. Results inconsistent with this hypothesis would be suggestive of adherence to the burial practices of either Shamanism or Lamaism.

CHAPTER II

BACKGROUND

Interpretive Framework: The Politicization of the Dead

Perez's (2012) theoretical framework, "the politicization of the dead", proposes that the body or bodies of the conquered—the victims of violence—are used as symbols by the conquerors—the perpetrators of the violence—to demonstrate their dominance and to differentiate themselves from the conquered group. This demonstration is accomplished through traumatic injury to the conquered individuals and through postmortem manipulation of their bodies. The bodies, in effect, are shaped by the specific methods of interpersonal violence employed by the conquering group. Therefore, understanding the culturally specific characteristics of the methods of violence used by a given group, as well as different contexts in which variations of these characteristics may be implemented, can allow the identification of culturally relative forms of violence. This approach can allow researchers to investigate the social identities of the conquered dead as well as the social identities of the perpetrators of the violence, and the cultural significance of different methods of violence and postmortem treatment evident on the bodies of conquered people (Perez, 2012). Application of the "politicization of the dead" framework to the HMC assemblage is achieved through investigating the various culturally significant forms of violence documented as having been practiced in Late Medieval Mongolia, as described in secondary historical sources and ethnographic

literature, and comparison of these modes of violence to the patterns of soft tissue trauma macroscopically evident on the mummified individuals as well as any skeletal ante- and postmortem trauma identified on 3D reconstructions of the CT scans.

Historical Background

Little primary literature written in Mongolian script exists from the Late Medieval period in Mongolia (Bold, 1999). The only detailed primary source from the early 13th century in Mongolia that is written in Mongolian is the *Secret History of the Mongols*, a literary work that describes the daily life and ideology of Mongols during this period. A translation of this reference by de Rachewiltz (2006) is employed extensively as historical reference here. There is a relative wealth of primary Chinese histories of Mongolia, which reflects China's long-lived interest in the migrations and politics of their northern neighbors (Bold, 1999). Primary Chinese sources include official dynastic histories, legal sources, and diverse records, such as travel reports (Bold, 1999). However, of the limited primary literature available, little has been translated into English. As most of the documentary evidence on Late Medieval Mongolia comes from Chinese historiographies (Bold, 1999), western researchers who do not read Chinese languages, like myself, are limited in available resources.

The documentary evidence primarily reviewed for this project is on the topic of Mongolian cultural practices surrounding combat-related violence, such as warfare and raiding; punitive violence, namely execution; religious practices and mortuary practices. Historical sources indicate that in the period succeeding the Yüan Dynasty, Mongolians, especially those in the southern regions bordering China, experienced widespread poverty and famine, intermittent conflict, and political upheaval due to internal struggles between

competing tribes over the fractured Mongolian Empire (Mote, 2000; Bold, 1999). Sources also indicate that traditional Mongolian pastoralist strategies eroded during the Yüan, which was exacerbated by climate change (Zhang et al., 2007). This contributed to increasing localized conflict and geographical displacement of pastoralist groups, which persisted throughout the 15th and early 16th centuries (Bold, 1999; Zhang et al., 2007).

As discerned from *The Secret History of the Mongols*, two forms of violence were common in Late Medieval Mongolia. These included combat-related violence, which included opportunistic raiding and large-scale warfare, and punitive killing in the form of execution. Secondary historical sources on Late Medieval Mongolia clearly indicate that each involved specific modes of violence and therefore specific patterns of trauma. If present, these patterns of trauma should be identifiable in preserved soft tissue and the skeletons of the HMC assemblage, and assignable to these modes. Combat-related violence was characterized by the use of projectile weapons, such as bows and arrows, and blades, such as scimitars (Bold, 1999; Kaszuba, 1996; de Rachewiltz, 2006). All of these weapon types should produce distinctive patterns of lacerations and sharp-force trauma. In contrast, punitive killing or execution was more performative and ideological, particularly in relation to religion, and varied in practice by the social status of the victim or victims (Broadbridge, 2008).

The secondary historical sources further suggest the existence of multiple mortuary practices to which distinct methods of postmortem treatment can be associated (Drobyshev, 2006). Specifically, the two predominant religions in Late Medieval Mongolia, Lamaism and Shamanism, featured distinctive mortuary practices, which varied by the social status of the deceased individual or individuals (Drobyshev, 2006).

These practices can be compared to the postmortem treatment of the HMC assemblage, with potential insight into the culturally specific rationale for the two-stage mortuary treatment.

Religion in Late Medieval Mongolia

Mongolian Religious Practice

Religion was a central theme in Mongolian culture, significantly influencing Medieval legal codes to the point where the law and religion were in many ways indistinguishable (Berger, 2011). During the Late Medieval period in Mongolia, Shamanism and Lamaism were the two most common religions, exerting great influence on legal codes, punitive activities, and mortuary practices (Bold, 1999). The first, Shamanism, is the indigenous religion of Mongolia and is believed to have been the primary religion of Mongolia prior to the introduction of Lamaism in the 13th century (Hesse, 1987). Mongolian Shamanism is a form of ancestor worship in which shamans and shamanesses communicated with spirits, made sacrifices to the spirits, and cared for the sick and injured. The second religion, Lamaism, is a form of Tibetan Buddhism. It was introduced into Mongolia from Tibet by ruler Qubilai Khan in the second half of the 13th century (Bold, 1999; Hesse, 1987). During the 13th century and most of the 14th century in Mongolia, Lamaism had little influence on the religious practice of Shamanism (Hesse, 1987), but this changed after the collapse of the Yüan Dynasty in 1368, after which Lamaism spread rapidly throughout Mongolia, becoming deeply influential. The roots of this proliferation are complex and are linked with the formation and emergence of multiple, clan-based polities in Mongolia (Hesse, 1987). These groups turned to Lamaism for a religious ideology to justify and authorize their social and

political superiority. As part of this, the vast majority of high status Mongolians, such as members of the nobility and ambassadors, converted to Lamaism in the 16th and 17th centuries. At the same time, the Lamaists sought to expand their political, economic, and religious influence in lay communities throughout Mongolia. High status Mongolians and Lamas worked together in the 17th century to forcefully convert Mongolian communities to Lamaism, specifically through the suppression of Shamanism (Hesse, 1987). This was achieved through the burning of Shamanistic idols and texts, and through the conversion, persuasion, torture, and murder of shamans (Heissig, 1953; Hesse, 1987). As part of this, some Shamanist traditions were allowed to continue to encourage conversion; for instance, many ancestor spirits were adopted as Lamaist deities (Hesse, 1987). Despite these campaigns, Shamanism did persist in some parts of Mongolia, specifically in remote, hinterland areas, into the 17th and 18th centuries and later (Hesse, 1987).

Violence and Religion: Shamanism

Shamanistic ideologies are directly relevant to the practice of violence in Late Medieval Mongolia. Specifically, following a contemporary Shamanistic world-view, blood was believed to contain the soul and therefore, was considered to be sacred (Drobyshev, 2006). The spilling of blood was viewed as wasting of a soul, and the aversion to doing so led to the development of various methods of punitive killing that prevented or limited blood loss. However, these methods were chosen according to an individual's social status. Specifically, while low status individuals might have been punitively killed in ways that caused blood loss, such as dismemberment, high status individuals-- such as members of the nobility, ambassadors, or human sacrifices-- were commonly not. Instead, they might have been subjected to bloodless methods of

execution, such as back-breaking, being trampled by horses, and strangulation through garroting (Drobyshev, 2006).

The Execution of Women and Children in Medieval Mongolia

There is little written in the historical record concerning the execution and treatment of women and children in Medieval Mongolia. During this period, women were not viewed as equal to men, but they were able to exert more freedoms than women in neighboring China (Mote, 1999). Women could wield considerable political power and influence and could fight alongside men, with some even controlling larger military units, possibly making them a target of political intrigue. However, women were also seen as acceptable spoils of conflict and could be taken as slaves (Mote, 1999). The status of children in Medieval Mongolia is also largely unknown. Accounts from traveler Ibn Batuta's journeys to Mongolia state that children could be similarly traded as acceptable compensation for the theft of livestock when the thief could not pay the fine. There are accounts of children executed as sacrifices during the Late Medieval period in Mongolia; in one of the only accounts of the method of human sacrifice found in the historical literature, Drobyshev (2008) retells of an instance when forty boys were killed bloodlessly as human sacrifices following the death of a noblewoman's son in 1585. It is also possible that children were targets in the factional wars following the collapse of the Mongolian Empire and possibly even the coincident assassination of individuals of Genghis Khan's lineage (Mote, 1999).

Religion and Mortuary Practice

In Late Medieval Mongolia, Shamanism and Lamaism involved distinct funerary practices (Crubezy et al., 2006). In Shamanism, burial and cremation were the primary methods of postmortem treatment (Roux, 1963 in Crubezy et al., 2006). Within this, however, there was great variation in funerary practices in and among different Mongolian tribes. This was due not only to social status but also to the limitations of the local environment; for instance, some areas were rocky and not conducive to burial (Crubezy et al., 2006). One reoccurring theme seems to be that secondary burial after a primary burial or cremation was not an uncommon practice (Crubezy et al., 2006). Following Shamanistic ideologies, high status individuals, such as Genghis Khan, were buried in mountaintops with human and animal sacrifices, as well as many grave goods (Drobyshev, 2006). In contrast, abandonment of a body on the surface, and exposure to the elements, constituted a violation of the remains, preventing the rebirth of the soul (de Rachewiltz, 2006; Drobyshev, 2006).

Secondary historical sources on Late Medieval Mongolian mortuary practices suggest that Lamaism also had a great influence on Mongolian funerary traditions (Drobyshev, 2006). Several of these traditions are directly opposed to those practiced in Shamanism (Drobyshev, 2006; Crubezy et al., 2006; Hesse, 1987). For instance, traditional Lamaists of this period engaged in a funerary practice known as a "sky burial," which is still practiced in modern Mongolia. This involves exposing recently deceased individuals to the elements, including scavenging, such as by birds. In contradiction to the Shamanistic belief, the more thoroughly and rapidly the remains were consumed, the sooner the soul of the deceased could be reborn. Exposure and

consumption by animals was believed by the Buddhists to be a person's last altruistic act. However, integration of Buddhist funerary practices into traditional Mongolian customs in the 16th and 17th centuries resulted in a sometimes ambiguous, hybrid combination of funerary practices; for instance, some individuals were still secondarily deposited and the remains of high status individuals were frequently interred in elevated places following exposure to the elements (Drobyshev, 2006; Crubezy et al., 2006; Hesse, 1987).

The Hets Mountain Cave Mummies

The HMC assemblage was recovered in 2004 as part of a joint effort by the Mongolian Academy of Sciences and the Smithsonian Institution National Museum of Natural History (NMNH) (Bazarsad et al., 2005). The assemblage was studied at the NMNH between 2004 and 2006 and then returned to the Mongolian Academy of Science in Ulaanbaatar for curation (Frohlich et al., 2008). While at the NMNH, multiple procedures were performed on the mummies, including AMS radiocarbon dating, x-ray imaging, macroscopic pathological and dental inventories, osteological inventories to the extent allowed by the presence of soft tissue, mtDNA analysis, stable and radiogenic isotope analysis to reconstruct diet and residential mobility, STR typing for sex identification, and limited macroscopic observations of skeletal and soft tissue trauma (Turner et al., 2012; Frohlich et al., 2005). Since most of the assemblage retains substantial soft tissue, largely precluding macroscopic evaluation of trauma on the skeleton, full body CT scans of the remains were also generated by Frohlich in 2004. The CT scans were used to aid in the reconstruction of depositional history of the assemblage (Frohlich et al., 2005). The observations of trauma in previous studies, as described below, were compiled from a macroscopic paleopathological inventory of the

individuals; analysis of trauma using the CT scans was cursory. Prior to this study, the CT scans had yet to be used to characterize in-depth the traumatic injuries of the individuals.

The Hets Mountain Cave is located in the Gobi Desert of southeastern Mongolia, approximately 5 kilometers north of the Chinese border at 42° 33' 33.7546' north latitude, 108° 14' 57.85615 east longitude, and at 1,106.09 meters in elevation (Bazarsad et al., 2005). The Gobi Desert is characterized by "pebbly-rocky plains" ranging in elevation from 900-1200 meters (Mares, 1999). Images from Dr. Frohlich (personal communication) indicate that the site is relatively elevated from the surrounding area, likely lending it's designation as "Hets Mountain" by locals. The natural cave consists of a subterranean chamber accessible via a small circular opening on the surface and several tunnels separated by platforms. The human remains were found piled in three groups in varying degrees of articulation (Bazarsad et al., 2005).

Figure 2 One of three groups of commingled remains from within the Hets Mountain Cave

(photo: Frohlich, personal communication).

The HMC assemblage includes an adult male and two adult females, all approximately thirty-five to sixty-five years of age; two juvenile males, one sixteen and one twelve years old; and four unsexed juveniles, one approximately eight years old, and three approximately two years old (see Table 1) (Frohlich et al., 2008). The sex of the adults was determined through macroscopic evaluation of soft tissue and sexually dimorphic aspects of the pelvis and skull, following Buikstra and Ubelaker (1994) (Turner et al., 2012). The juveniles were sexed via soft tissue and STR typing. All of the juveniles were aged via long bone metrics and dental eruption, also following Buikstra and Ubelaker (1994) (see Turner et al., 2012).

Table 1 Individual sex and age estimates, mtDNA haplogroups, and estimated AMS dates.

Specimen	Sex	Age	mtDNA HpG	AMS Date (cal. ^{14}C $\pm 2\sigma$)	Soft tissue trauma	Condition
3-A	n/d	1.75-2.5 yrs	n/a	n/a	None	Not described.
3-B	n/d	2.0-2.5 yrs	D1 (16223 16325)	n/a	Soft tissue shows evidence of strangulation; cord found around neck *in situ*.	Post-crania present some soft tissue present.
3-C	n/d	1.25-2.0 yrs	D1 (16223 16325)	n/a	Soft tissue shows evidence of strangulation; cord found around neck *in situ*.	Post-crania present soft tissue present on ~70% of body.
1-A	Female	~40+ yrs	n/a	n/a	None	Not described.
1-B	Male	14-16 yrs	n/a	AD 1434-1528 (399 BP)	None	Post-crania present soft tissue present.
1-C	n/d	~8 yrs	n/a	AD 1456-1651 (323 BP)	None	Crania, post-crania dentition, and hair present; soft tissue present on 60% of the body.
1-D	Female	35-40 yrs	C (16223 16298 16319 16327)	AD 1439-1524 (393 BP)	Tongue severed perimortem at occlusal line of dentition; likely involuntarily severed coincident with cervical trauma.	Crania and post-crania present; dentition and hair present; minimal soft tissue present on ~60% of body.
1-F	Male	~12 yrs	D1 (16223 16325)	n/a	None	Post-crania present dentition, hair, and soft tissue present
1-G	Male	~40+ yrs	n/a	n/a	Soft tissue shows evidence of strangulation; cord found around neck *in situ*. Tongue severed perimortem at occlusal line of dentition; likely involuntarily severed coincident with cervical trauma.	Crania and post-crania present; dentition and hair present; soft tissue present on ~50% o body.

(Frohlich et al. 2008; Turner et al. 2012)

Many of the juveniles were missing crania and limbs and exhibited varying amounts of soft tissue. All of the juvenile skeletal remains exhibit gross evidence of perimortem sharp and blunt force trauma to the cranial and cervical regions. This is interpreted as being consistent with garroting or strangulation, which is supported by

the presence of garroting cords recovered *in situ* with two of the juveniles, those aged approximately two years of age (Frohlich et al., 2005). Preliminary results from analysis of the mtDNA haplogroups indicate a biological relationship between the two infants, the twelve year old, and the adult female; mtDNA analysis was not performed on the eight year old and sixteen year old (Frohlich et al., 2008; Turner et al., 2012).

One adult female (1-D) retained a cranium, dentition, hair, and post-crania, and some residual soft tissue on the body (Turner et al., 2012). This individual exhibits gross evidence of trauma to the posterior cervical region, which researchers have interpreted as compatible with having a strong rod or bar- like object, such as a piece of wood, placed posteriorly and the head forced backwards (Frohlich et al., 2012). Additionally, the individual's tongue is severed along occlusal line of the dentition, which likely occurred involuntarily, coincident with the cervical trauma (Bazarsad et al., 2005; Turner et al., 2012; Frohlich et al., 2013). Preliminary, cursory evaluation of the CT scans also indicated that the female exhibits evidence of multiple instances of blunt force perimortem trauma to the pelvic region (Frohlich et al., 2008; Turner et al., 2012).

The male retained crania and post-crania and some soft tissue. The individual also exhibits gross evidence of sharp and blunt force trauma to the cranial and cervical regions. Additionally, the individual's tongue is severed along occlusal line of the dentition, which likely occurred involuntarily, coincident with the cervical trauma. A garroting cord was also recovered *in situ* in the cervical region (Turner et al., 2012).

Stable and radiogenic isotopic analyses performed by Turner and colleagues (2012) established the dietary and residential histories of individuals in the HMC assemblage and contextualized the results within historical and ethnographic evidence. As previously stated, the Late Medieval period in Mongolia featured widespread famine, during which traditional Mongolian pastoral economies eroded, and diets of many communities were supplemented with agricultural products, such as grain (Zhang et al, 2007). Turner and colleagues found that all of the individuals had maintained stable, traditional pastoral diets throughout their lives, as evidenced by consistent δC^{13} signatures, and that all but the adult male were lifelong local residents of the southern Gobi desert, as evidenced by their oxygen isotope ratios (Turner et al., 2012). They further observed during macroscopic evaluation that all but the adult male lacked macroscopic evidence of antemortem trauma, metabolic disease and other pathologies, as well as skeletal and oral stress indicators. Collectively, these findings were interpreted as evidence that the HMC individuals, with the exception of the adult male, were not involved in the widespread famines and erosion of pastoral practices documented during the period, and that they were not refugees or prisoners of war from large-scale, contemporary conflicts.

CHAPTER III

MATERIALS AND METHODS

The methodologies and strategies used in assessing trauma often vary dependent on the purpose of the research (Vega Dulanto, 2016). For example, methodologies can be centered on identifying victims of human rights violations (eg. Rodriguez-Martin, 2006), understanding trauma in forensic contexts (eg. Wedel, 2014), and identifying and interpreting trauma in archaeological contexts (eg. Lovell, 2008; Lovell, 1997). Bioarchaeological studies employ these methods to answer a variety of questions, such as investigating the presence, frequency, and nature of violence within a sample (eg. Bourbou, 2009; Spencer, 2012), exploring the role of violence in the midst of advancing subsistence change (eg. Roksandic et al., 2006; Standen et al., 2009), examining the nature of warfare and violence between sociopolitical entities (Smith, 2003), and the increase of violence in response to ecological pressures (eg. Scott & Buckley, 2010). Though the questions posed by bioarchaeological studies vary greatly, they all focus on the common variables of biological profile, trauma timing, location and number of lesions, the characteristics of the fractures, and the mechanism of the injury (Vega Dulanto, 2016). It is through the bioarchaeological study of trauma that researchers dispel preconceived notions about past societies through the systematic study of the only archaeological resource able to provide direct evidence on human health and violent interaction in the past (Larsen, 1997).

This project used the aforementioned CT scans, photographs, and mortuary evidence from the HMC assemblage (n=9), embedded within primary and secondary historical sources from the Late Medieval period in Mongolia. The CT scans and photographs were used to identify and characterize patterns of trauma of the HMC assemblage. The CT scans were also interpreted alongside mortuary evidence and secondary historical sources on contemporary modes of conflict and violence and mortuary treatment to understand better the postmortem treatment of the individuals.

CT Scans

Identification and characterization of traumatic injuries were accomplished through systematic assessment of the individuals' full body 3D CT scans, supplemented with original photographs of the remains, taken by Bruno Frohlich in 2004, to clarify whether the fractures were antemortem, perimortem or postmortem in timing. Many scholars fervently argue for collaborative analysis on archaeological CT data or consultation with a radiologist at a minimum, to ensure accuracy of diagnoses (O'Brien et al., 2009; Chhem et al. 2008). Following this argument, I collaborated with radiologists Dr. Eric Lawson and Dr. Russell Allman to ensure that my identification and characterization of the trauma patterns in the assemblage was accurate. The individuals were CT scanned on a Siemens Emotion scanner, following a consistent scan protocol (slice: 0.5mm, mAs 83; voxel: 0.375). My identification and diagnosis of skeletal trauma in the assemblage followed the protocols for paleoradiological methods of diagnosis of skeletal pathologies set by Chhem and colleagues (2008).

Chhem and colleagues' (2008) methods were written from the perspective of a professional radiologist for paleopathologists, using clinical terminology, and thus take

an empirical clinical approach that is replicable. Their methods also facilitated my consultation with the radiologists. Chhem and colleagues' (2008:75) protocol for paleoradiological diagnosis is as follows:

1. Obtain the best x-ray image of the specimen
2. Identify the lesion
3. Analyze systematically the basic x-ray patterns of the lesion
4. Combine relevant basic x-ray patterns
5. Determine if the x-ray abnormality is the result of taphonomic (post-mortem, environmental) alteration
6. Discuss differential diagnosis
7. Always discuss pseudopathology (false-pathology)
8. Suggest the final diagnosis from the broad category of bone and joint diseases

I applied these methods to CT scans, rather than x-rays, but otherwise proceeded through all of the above steps in my evaluation of the scans. Importantly, I also proceeded through steps 2 to 8 in direct consultation with the two radiologists. I used Horos, which enables 3D image reformatting and interpretation, to generate high-resolution images of the whole body scans of the individuals for step 1, and used these images to accomplish step 2. I used the protocols described by Lovell (1997) as the method for describing and diagnosing traumatic injuries ('lesions') for steps 3 and 6, and identifying and rejecting 6. These protocols were chosen because they are derived from clinical and forensic medicine, with attention to the traumatic injuries most common on archaeological skeletons, and because they mirror the terminology used in the methods

defined by Chhem and colleagues (2008). Clinically derived terminology bridges the gap between anthropology and clinical medicine during collaboration and consultation with medical professionals.

Data Collection

Inventory of the remains was completed using the Inventory Recording Form for Complete Skeletons from Buikstra and Ubelaker (1994). For the inventory, elements were recorded as either present or absent based on presence within the frame of the CT scans; present was recorded with a checkmark and absent was recorded as a dash. Fractures were recorded using a form I created, the Hets Mountain Cave Collection Fracture Observation Form, which was adapted from Buikstra and Ubelaker's (2004) Paleopathology Recording Form I to incorporate Lovell's (1997) fracture types and estimated timing of fractures. Lovell (1997) classifies mechanisms of injury and the traumatic skeletal injuries consistent with these injuries, as well as providing criteria for determining whether injuries likely occurred antemortem, perimortem, or postmortem.

First, the CT scans were interpreted in order to characterize the fracture patterns of any injuries and the photographs were used to observe surface texture in order to identify fracture surface staining, where possible. During fracture observation, the bone, the side of the body from which the bone came, and the section/aspect of the bone affected were recorded to describe the location of the fracture. Following Lovell, the types of fractures evident on the CT scans were identified and recorded based on the 'comments' or descriptions of trauma in Table 2; cranial fractures were categorized as linear, depression, or penetrating fractures. These fractures were then classed by mechanisms of injury, including direct trauma, indirect trauma, stress, and trauma

secondary to pathology (see Table 2). Injuries resulting from direct trauma were then classed as resulting from blunt force or sharp force trauma. Following Lovell, the identified fractures were classed as antemortem, perimortem, or postmortem. Antemortem fractures are those with evidence of healing, such as callus formation. Fractures lacking evidence of healing and exhibiting "the uniform presence of stains from water, soil, or vegetation on broken and adjacent bone surfaces, the presence of greenstick fractures, incomplete fractures, spiral fractures, and depressed or compressed fractures, oblique angles on fracture edges, and/or a pattern of concentric circular, radiating, or stellate fracture lines" were classified as perimortem (Lovell, 1997:145). Postmortem fractures were identified by the presence of "smaller fragments, nonuniform coloration of the fracture ends and the adjacent bone surface, especially light-colored edges, squared fracture edges, and absence of fracture patterning due to increased tendency of dry, brittle, bone to shatter on impact" (Lovell, 1997:145).

Table 2 Summary of mechanisms of injury and associated types of fractures

Mechanism of Injury	Type of fracture	Comments
Direct trauma	Penetrating	Partial or complete penetration of bone cortex
	Comminuted	Bone is broken in more than two pieces; most common in long bone diaphyses
	Transverse	Force applied in a line perpendicular to long axis of the bone
	Crush	Most common in cancellous bone
	Depression	Crushing force on one side of the bone
	Compression	Crushing force on both sides
	Pressure	Force applied to growing bone
Indirect trauma	Spiral	Rotational and longitudinal stress on long axis; often confused with oblique fracture
	Oblique	Rotational and angular stress on long axis; often confused with spiral fracture
	Torus/greenstick	Bending of the bone due to longitudinal compression; common in children
	Impacted	Bone ends are driven into each other
	Burst	Found in the spine due to vertical compression
	Comminuted	Force splits in several directions and forms a "T" or "Y" shape
	Avulsion	Fracture due to tension at ligament or tendon attachment
Stress		Due to repetitive force, usually perpendicular to long axis May be confused with direct trauma transverse fracture
Secondary to pathology		Secondary to localized or systemic disease that has weakened the bone

(Lovell 1997: 141)

CHAPTER IV

RESULTS

Skeletal Trauma in the HMC Assemblage

The Hets Mountain Cave collection was assessed for skeletal trauma using 3D CT scans. A summary of the classified trauma identified in the assemblage through evaluation of the CT scans by myself and the radiologists is provided in Table 3.

Table 3 HMC Skeletal Trauma

Specimen	Condition	Skeletal Trauma
3-A	Post-cranial axial skeleton present, excluding most of the right ribs. Left and right femurs present; left tibia present. Bones of the arms, hands, and feet absent.	• Postmortem rib fracture on left ribs 6-9 & right ribs 6 & 7, all at the neck. • Postmortem fracture on left rib 2 at the rib body. • Dislocation between the ossification centers of C1.
3-B	Post-cranial axial skeleton present. Left and right legs present. Bones of the arms, hands, and feet absent.	• Postmortem fracture on right ribs 2-6 & left ribs 2-6, all at the midshaft. • Postmortem fracture on right ribs 1 & 7, both at the neck. • Postmortem crush fracture on the proximal diaphysis of the left tibia.
3-C	Post-cranial axial skeleton present. Right humerus, right ulna, and right femur present. Bones of the right radius, right tibia and fibula, left arm, left leg, both hands, and both feet absent.	• Postmortem dislocation of the C1 from the vertebral column at the inferior synovial joint. • Postmortem crush fracture of the distal ulna.
1-A	Post-cranial axial skeleton present, excluding cervical vertebrae. Left and right femur present. Bones of the arms, lower legs, hands, and feet absent.	• Antemortem fracture on right rib 4 at the body & left rib 8 at the angle. • Postmortem fracture on left ribs 2-5 & right ribs 2-5 & 8, all at the rib angle • Postmortem fracture on left rib 6 at the neck. • Postmortem fracture of C7 at the spinous process.

Table 3 (continued)

1-B	Post-cranial axial skeleton present, excluding most cervical vertebrae. Left and right femurs, left tibia, and left fibula present. Bones of the arms, right lower leg, hands, and feet absent.	• No visible skeletal trauma.
1-C	Crania and axial skeleton present. Left humerus, left and right legs, and feet present. Bones of the Left lower arm, right arm, and hands absent.	• Perimortem linear fractures on the frontal and left parietal. • Postmortem crush fracture of the distal humerus.
1-D	Axial skeleton present, including crania. Right femur present. Bones of the right lower arms, left arm, legs, hands, and feet absent.	• Perimortem crush-compression fractures on C 4-6. • Perimortem dislocation of the coccyx at the sacral articulation. • Postmortem penetrating fracture on the maxilla and left parietal, respectively. • Postmortem fractures on left ribs 2-4, all at the angle. • Postmortem fracture on right rib 5 at the body • Postmortem fracture on the T5 at the spinous process.
1-F	Post-crania axial skeleton present, excluding cervical vertebrae. Left and right femurs, right tibia and right fibula present. Bones of the lower left leg, arms, hands, and feet absent.	• No visible skeletal trauma.
1-G	Crania, C1-T3 & L5, right ribs, and pelvis present. Right humerus, left and right femurs present. Bones of the lower left leg, lower right arm, left arm, and hands absent. Lower right leg and foot present but not visible.	• Antemortem fracture on the right nasal • One continuous perimortem linear fracture spanning the left and right parietals. • Perimortem crush-compression fractures on C3-5. • Postmortem penetrating fracture on frontal. • Postmortem fractures on right ribs 5, 6, & 8, all at the rib angle. • Postmortem fracture of right rib 9 at the midshaft. • Postmortem dislocation of ilium at the sacroiliac joint.

Description of Trauma by Individual

3-A

Figure 3 Individual 3-A

(photo: Frohlich, personal communication).

Individual 3-A retains most of the post-cranial axial skeleton, excluding most of the right ribs; the left and right femur; and the left tibia. Bones of both arms, left fibula, right lower leg, hands, and feet are all absent (Figure 3). 3-A exhibits a rib fracture to each of the left ribs 6 to 9 and right ribs 6 and 7, all at the rib neck that wind down and around the rib shaft, consistent with spiral fracture. The individual exhibits a fracture of left rib 2 at the rib body that angles across the shaft, consistent with oblique fractures (Figure 4). These spiral and oblique fractures all result from indirect trauma and exhibit irregular fracture lines consistent with more brittle, dry bone typical of postmortem fractures. The absence of soft tissue in the fracture areas make it likely that the damage occurred during the postmortem removal of limbs and repositioning of the bodies. Though Lovell (1997) states that spiral fractures are indicative of perimortem trauma, Keiser and colleagues (2013:193) describe complete "butterfly" and "half-butterfly" rib fractures that exhibit "long linear load-extension curves, followed by relatively short non-linear elastic (hyperelastic) behavior and brittle fracture" as typical dry bone fracture

patterns. The “half-butterfly” fractures described are similar to the fractures I have classified as “spiral”, but because half-butterfly fractures are not included in the fracture typology provided by Lovell (1997), I will continue to use the term “spiral” to classify these fractures, and will differentiate spiral rib fractures from spiral long bone fractures where necessary. Individual 3-A also exhibits a slight dislocation of C1 in the form of a malunion of the ossification centers at the anterior aspect, where the right ossification center appears shifted superiorly. This dislocation is likely postmortem and unlikely to be perimortem, given the torn appearance of the soft tissue and is likely coincident with the removal of the crania. Individual 3-A exhibited no injuries consistent with antemortem or perimortem skeletal trauma, as defined by Lovell (1997).

Figure 4 Individual 3-A with postmortem rib fractures.

3-B

Figure 5 Individual 3-B

(photo: Frohlich, personal communication).

Individual 3-B lacks a cranium, but retains much of the axial skeleton, including the cervical vertebrae; 3-B retains the left and right legs; some of the left foot, and all but the phalanges in the right foot. Bones of both arms and hands are absent. 3-B presented with a fracture on each of the right ribs 2 to 6 and left ribs 2 to 6, all at the rib midshaft, that wind down and around the rib shaft and are consistent with spiral fractures. The individuals exhibit fracture to right ribs 1 and 7 both at the rib neck that angle across the rib shaft and are consistent with oblique fractures. All of the spiral and oblique rib fractures are resultant of indirect trauma and exhibit irregular fracture lines consistent with dry bone, postmortem fracturing. 3-B also exhibited a fracture to the anterior aspect of the proximal diaphysis of the left tibia; this fracture area appears circular in shape, and presents as a crater-like lesion affecting the cancellous bone consistent with crush fractures, a form of blunt force direct trauma. Neither bone fragments nor protective soft tissue are present in the area of the injury. Fracture edges appear irregular, which

indicates that the injury likely occurred postmortem, as it is consistent with the crushing of brittle, dry bone. Individual 3-B exhibited no injuries with consistent with antemortem or perimortem skeletal trauma, as defined by Lovell (1997).

3-C

Figure 6 Individual 3-C

(photo: Frohlich, personal communication).

Individual 3-C lacks a cranium, but retains the rest of the axial skeleton, including all of the cervical vertebrae; retains right humerus; right ulna; and right femur. Bones of the left arm, right radius, left leg, right lower leg, hands, and feet are absent. 3-C shows evidence of displacement of the C1 from the vertebral column at the inferior synovial joint, which is consistent with dislocation, a form of indirect trauma. The C1 is intact and there is no evidence of injury to the surrounding bone to suggest this injury occurred perimortem; this dislocation likely occurred with the postmortem removal of the crania. The location of the cord recovered *in situ* is much lower on the cervical vertebrae, further suggesting the dislocation did not occur with strangulation (Figure 7). 3-C also presents with an irregular bell-shaped fracture affecting the cancellous bone on the medial aspect

of the distal end of the right ulna; no bone fragments from this injury were present. This is consistent with a crush fracture, which is a form of direct trauma caused by blunt force. The irregular fracture circumference is consistent with dry bone injury. The lack of soft tissue to protect the bone during postmortem manipulation and the postmortem loss of several surrounding bones, including the right radius and right hand, further indicates that this injury occurred postmortem. Individual 3-C exhibited no injuries with consistent with antemortem or perimortem skeletal trauma, as defined by Lovell (1997).

Figure 7 Individual 3-C (Left) with a dislocated C1; (Right) cord embedded in neck (right image: Frohlich, personal communication).

Figure 8 Individual 1-A

(photo: Frohlich, personal communication).

Individual 1-A retains the majority of the post-cranial axial skeleton, excluding all of the cervical vertebrae; retains left and right femur (Figure 8). Bones of both arms, both lower legs, hands, and feet are all absent. The individual presents a fracture on the rib bodies of right rib 4 and left rib 8, both of which exhibit bony growth in the form of a callus. The left rib 8 also has a small bony projection on the superior aspect of the body at the callus that is consistent with an osteophyte. Neither rib fracture exhibits a visible fracture line due to remodeling, though the angle of the callus indicates the fracture on both ribs was likely transverse, a direct trauma injury resulting from blunt force. The presence of healing indicates that the fractures occurred antemortem. 1-A presents with a fracture line that angles across the spinous process of C7, of which only the spinous

process remains. The fracture is consistent with an oblique fracture, which is caused by indirect trauma. The fracture line is irregular, consistent with dry, brittle bone; the injury is likely postmortem, occurring with the removal of the skull and all of the cervical vertebrae. The individual also has a fracture on each of the left ribs 2 to 5 at the rib angle that angles across the rib shaft, consistent with oblique fracture, with splintering at the fracture end. A fracture on the left rib 6 at the rib neck also winds down and around the rib shaft, consistent with spiral fracture, and exhibits splintering at the fracture end (Figure 9). These oblique and spiral fractures all result from indirect trauma. The fractures all exhibit irregular fracture lines with splintering at the margins consistent with more brittle, dry bone typical of postmortem fractures. A fracture is also present on each of the right ribs 2 to 5 and 8 at the rib angle that curve down and around the rib shaft, consistent with spiral fracture resultant of indirect trauma. These fractures exhibit irregular fracture lines consistent with dry, brittle bone, and likely occurred postmortem. The absence of soft tissue surrounding the fracture areas make it likely that the damage occurred during the postmortem removal of limbs and manipulation of the bodies. The individual presented no injuries consistent with perimortem trauma.

Figure 9 Individual 1-A thorax.

1-B

Figure 10 Individual 1-B

(photo: Frohlich, personal communication).

Individual 1-B lacks crania and C1-C6, but retains C7 and the rest of the axial skeleton, as well as the left and right femur, the left tibia, and the fibula (Figure 10).

Bones of both arms, lower right leg, hands, and feet are absent. The individual exhibits no visible skeletal trauma.

1-C

Figure 11 Individual 1-C
(photo: Frohlich, personal communication).

Individual 1-C retains all of the axial skeleton, including the cranium and cervical vertebrae; the left humerus; the left and right legs, excluding the left patella; the left foot, excluding the phalanges; and the tarsals of the right foot. Bones of the arms and hands are absent (Figure 11). 1-C exhibits a single fracture line on the frontal bone that radiates from above the left orbit towards the coronal suture, consistent with a linear fracture. No depression was observed in association with the fracture. The injury likely resulted from direct trauma by blunt force. The fracture was incomplete with no fragmentation, a characteristic consistent with green bone, indicating that the injury likely occurred perimortem. 1-C also presents with four fracture lines radiating in a star-pattern, or stellate, from a single point of origin on anterior inferior aspect of the left parietal, with a small fragment of bone missing from along the squamosal suture at the sphenoidal angle

(Figure 12). No observable depression was found at the origin of the fracture lines, indicating that the injury is consistent with radiating linear fractures, an injury of direct trauma typically resultant of blunt force trauma. The fracture lines radiate as follows: anteriorly, connecting with the coronal suture; anterior-inferiorly, connecting with the sphenoidal angle; posterior-inferiorly, connecting with the squamosal suture; and posterior-superiorly towards the center of the parietal body. The fracture lines appear in a stellate pattern, one of the four fracture lines is incomplete, and all of the fracture lines are regular; all of these are characteristics of green bone, indicating that the injury likely occurred perimortem. The area of the sphenoidal angle where the small fragment of bone is absent lacks soft tissue to hold the fragment in place and shows no evidence of crushing consistent with dry bone, leading me to believe the fragment fell out postmortem. 1-C also shows an irregular crescent-shaped puncture on the right orbital plate of the frontal bone that is consistent with a penetrating fracture. Following Lovell (1997), the penetrating fracture results from direct trauma that is sharp force in nature. The fracture circumference presents with very irregular lines and lacks observable evidence of beveling, or compression, thus is consistent with postmortem trauma. The individual exhibits a crater-like fracture affecting the cancellous bone on epicondyle of the left humerus that is consistent with a crush fracture. Crush fractures are typically associated with direct trauma cause by blunt force injury. There is no protective soft tissue in the area of the fracture and bone fragments are absent. The fracture also has irregular edges and no evidence of depression or radiating fracture lines, indicating that the injury is consistent with a dry bone fracture and thus is likely postmortem. The individuals exhibits no evidence consistent with antemortem trauma.

Figure 12 Individual 1-C with perimortem blunt force trauma to the cranium in the form of linear fractures.

1-D

Figure 13 Individual 1-D

(photo: Frohlich, personal communication).

Individual 1-D retains a complete axial skeleton and the right femur. Bones of the left leg, lower right leg, both arms, hands, and feet are all absent (Figure 13). The

individual exhibits fractures with fragmentation on the vertebral arches of the C4 to C6 vertebrae; all of the involved vertebrae exhibit fragmentation of the spinous processes, with C6 being the only vertebrae to exhibit a fracture line radiating across the right lamina at an angle. The highly fragmented, or comminuted, nature of fracture area and the presence of radiating fracture lines indicated that the injury is consistent with a crush-compression fracture. Following Lovell (1997), this fracture is likely caused by blunt force, direct trauma. The presence of a fracture line radiating from the point of the crush is consistent with green bone; photographs of the area exhibit no inconsistencies in color in exposed bone or tissue consistent with recent damage, indicating that the injury likely occurred perimortem. This individual has been interpreted as exhibiting evidence of having the head forced backwards over a rod or bar (Figure 14) (Frohlich et al., 2005). Based on the location of the injury at the cervical spine, Dr. Lawson advised that this injury likely did not produce instant death, but rather possibly caused an inability to breathe, resulting in suffocation.

1-D also presents with a malunion of the coccyx with the sacrum, where the coccyx is at a near right angle to the sacrum, which is consistent with a partial dislocation, or subluxation, of the coccyx at the sacrococcygeal joint. This injury is likely resultant of indirect trauma to the joint, with the trauma possibly having been applied directly to the coccyx itself by blunt force to the posterior. The coccyx is still attached to the sacrum due to the presence of soft tissue at the joint, and there is no observed fracture to the coccyx or sacrum (Figure 15). The bone likely desiccated in that position, otherwise the force sufficient to bend the coccyx in that direction would likely cause more damage to the bone and to completely dislocate the coccyx from the body, given the

lack of elasticity of desiccated soft tissue, but this degree of trauma is not present. Due to this, I find that the dislocation is likely perimortem.

The individual also exhibits a fracture on each of the left ribs 2 to 4 near the rib angle and right rib 5 at the rib body that wind down and around the rib shaft, consistent with spiral fracture. These fractures are resultant of indirect trauma. The affected areas have little protection via soft tissue and present with irregular fracture lines consistent with dry bone, indicating that the injury likely occurred postmortem. The individual presents with a fracture line running perpendicular to the longitudinal axis of the spinous process of T5 consistent with a transverse fracture. Lovell (1997) associated transverse fractures with direct trauma caused by blunt force. The fracture line is irregular, consistent with dry bone, indicating that the injury likely occurred postmortem. 1-D also shows a puncture that completely penetrates the bone on the left parietal and a puncture that does not completely penetrate the bone on the exterior surface of the maxilla above the right central incisor; both fractures are consistent with penetrating fracture. Following Lovell (1997), penetrating fractures result from direct trauma due to sharp force. The fractures lack evidence depression, or radiating fracture lines, and are likely postmortem due to the lack of regular-shaped fracture lines and beveling. Review of the CT scans of the pelvic region by the radiologists found no convincing evidence of fractures consistent with blunt force pelvic trauma, other than the dislocated coccyx. The individual exhibited no evidence of antemortem trauma.

Figure 14 Individual 1-D with cervical vertebrae trauma.

Figure 15 Individual 1-D with dislocated coccyx.

Figure 16 Individual 1-F

(photo: Frohlich, personal communication).

Individual 1-F lacks a cranium and cervical vertebrae, but retains the rest of the axial skeleton, the left and right femurs, the right tibia, and the right fibula. Bones of both arms, the left lower leg, hands, and feet are absent (Figure 16). The individual exhibits no evidence of skeletal trauma. What I initially thought to be a postmortem dislocation and loss of the left rib twelve was instead identified as a possible hypoplastic, or under-developed, rib by Dr. Lawson.

1-G

Figure 17 Individual 1-G, upper portion with the garroting cord *in situ* (photo: Frohlich, personal communication).

Individual 1-G was recovered with the upper body dislocated from the lower body; these portions were later re-associated (Frohlich et al. 2005). 1-G retains a cranium, C1-T3 and L5, the right ribs, pelvis, the right humerus, and the left and right femurs. Bones of the left arm, right lower arm, lower legs, hands and feet are absent. The pelvis and proximal femurs were the only elements in frame in the CT scans of the lower body. The individual presents with a faint fracture line with some bony formation extending up the right nasal bone with a fragment missing from the inferior edge (Figure 18). The fracture shows no evidence of depression and is consistent with a linear fracture, which is resultant from blunt force direct trauma. The presence of a callus indicates that this injury occurred antemortem. The individual exhibits fractures with fragmentation on the vertebral arches of the C3 to C5 vertebrae; all of the involved vertebrae exhibit fragmentation of the spinous processes (Figure 19). The highly fragmented, or comminuted, nature of fracture area indicate that the injury is consistent with a crush-

compression fracture, similar to individual 1-D. Following Lovell (1997), this injury was likely caused by blunt force, direct trauma. No images of the injured area were available to assess the condition of the soft tissue or coloration of the bone, if visible. Given the similarity of the cervical injuries of 1-G to 1-D, this injury is also likely perimortem.

A fracture line extends from the body of the right parietal to the frontal angle, then along the coronal suture of the L parietal with no obvious depression, indicating that the fracture is consistent with a linear fracture (Figure 20). Linear fracture in the cranium is resultant from direct, blunt force, trauma. Given that the fracture line is regular and incomplete on the right parietal, which is consistent with green bone, this injury likely occurred perimortem. 1-G presents with a malunion of the right ilium from the sacrum, consistent with dislocation at the sacroiliac joint. Dislocations result from indirect trauma. Dr. Russell advised that dislocations at the sacroiliac joints typically occur symmetrically to both joints. There is no evidence of fracturing to elements of the joint, which also lacks soft tissue to hold the sacrum and the ilium together. Given the non-symmetrical nature of the dislocation and the likelihood that these elements separated following loss of soft tissue, this dislocation likely occurred postmortem.

1-G presents with a complete puncture lateral to the right orbit on the frontal bone, consistent with penetrating fracture. The fracture exhibits no evidence of depression or radiating fracture lines, and is consistent with direct trauma by sharp force. The fracture line around the circumference is irregular, and there is no evidence of beveling, indicating that the injury is likely postmortem. A fracture line winds down and around each rib shaft on the right ribs 5, 6, and 8 at the rib angle and right rib 9 at the midshaft, consistent with spiral fracture. Following Lovell (1997), spiral fractures result

from indirect trauma. The rib fractures are all likely postmortem due to the irregular fracture lines that are consistent with dry bone. There is additional fracture along the length of medial border of the right scapula, with missing sections of bone (Figure 21). The fracture is extremely jagged, indicative of fragmentation, which is most consistent with the comminuted nature of crush fracture resulting from direct blunt force trauma. This injury likely occurred with the postmortem manipulation of the bodies, evident by jagged, irregular fracture patterning, which is consistent with dry bone fracturing.

Figure 18 Individual 1-G with antemortem healed nasal fracture with missing nasal fragment.

Figure 19 Individual 1-G with perimortem crush fractures to the spinous processes of the cervical vertebrae.

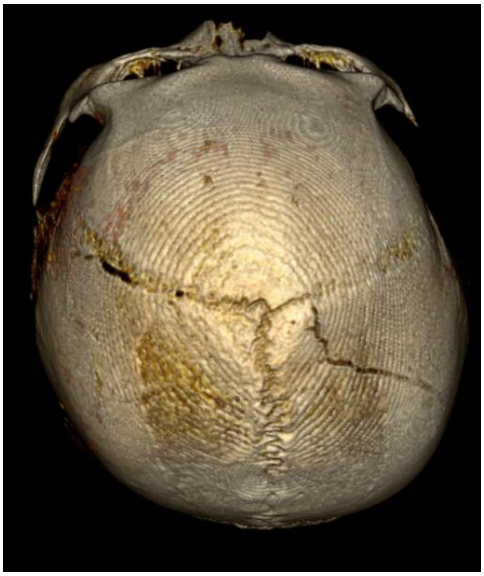

Figure 20 Individual 1-G with perimortem left and right radiating parietal fractures consistent with blunt force trauma.

Figure 21 Individual 1-G with postmortem complete fracturing along the medial border of the right scapula.

CHAPTER V

DISCUSSION

Perimortem Trauma among the HMC Individuals

Seven of the nine HMC individuals exhibited evidence of skeletal trauma in the CT reconstructions. However, only four of the nine individuals exhibited fractures consistent with antemortem or perimortem skeletal trauma, with one (1-A) of the four presenting with antemortem fractures and no perimortem fractures. Two of the three individuals with crania present for observation exhibited blunt force cranial trauma. Two of the three adults presented with crush-compression fractures on the posterior aspect of the cervical vertebrae. A total of three individuals exhibited soft tissue evidence of strangulation with all three recovered with garroting cords found around their necks *in situ* (Frohlich et al., 2008; Frohlich et al., 2005; Turner et al., 2012). Two of the five individuals without antemortem or perimortem skeletal trauma were those found by Frohlich and colleagues (2008) to exhibit soft tissue evidence of strangulation, both with cords found around their necks *in situ.* In short, only five of the nine HMC individuals exhibit evidence consistent with perimortem soft tissue or skeletal trauma that suggest a cause of death.

It was hypothesized that the patterns of trauma would be consistent across all of the HMC individuals, suggesting that the individuals died the same way at the same time (**H_1**). None of the remains exhibited injuries indicative of perimortem sharp force trauma,

such as that produced by a sword, knife, spear or arrow. The individuals who presented with perimortem injuries can be summarized into four groups by possible cause of death: strangulation (3-B and 3-C), blunt force cranial trauma (1-C), blunt force trauma to the posterior cervical region (1-D), or a combination of these mechanisms of injury (1-G). These patterns of trauma are consistent in that they all lack evidence of sharp-force trauma and exhibit injuries consistent with various blunt force trauma. This finding supports hypothesis $\mathbf{H_1}$ that the HMC individuals exhibit perimortem injuries consistent across the assemblage and were likely killed during the same event.

Table 4 Summary of Perimortem Injuries

Specimen	Strangulation	Blunt Force Cranial Trauma	Blunt Force Cervical Trauma	Blunt Force Pelvic Trauma
3-A	-	-	-	-
3-B	X	-	-	-
3-C	X	-	-	-
1-A	-	-	-	-
1-B	-	-	-	-
1-C	-	-	X	-
1-D	-	X	-	X
1-F	-	-	-	-
1-G	X	X	X	-

The variation that does exist in the types of blunt force perimortem injuries present may be indicative of differing treatments between the individuals based on sex, age or social status. For example, only two of the adults (1-D and 1-G) exhibited blunt force trauma to the posterior cervical region, suggesting that this method of injury may have been specific to them based upon their age status. The third adult, (1-A) lacked crania and cervical vertebrae for comparison. The adult male (1-G) is the only individual to present with a combination of strangulation, blunt force cranial trauma, and blunt force

cervical trauma. The adult male is also the only individual to exhibit oral pathologies, and is the only individual who underwent isotopic tests that was shown to possibly have been non-local to the region (Turner et al., 2012). This suggests that this individual's unique perimortem treatment may be related to their status as a non-local, an adult male, or both. While 1-B could also be considered an adult male, this individual lacks crania and cervical vertebrae for comparison.

The individuals who exhibit evidence of strangulation include one adult male (1-G) and two unsexed juveniles (3-B and 3-C), suggesting that this method of execution was not exclusive to either adults or children. Only one of the two adult females (1-D) exhibited evidence consistent with blunt force trauma to the pelvic region, which indicates that this method of perimortem treatment was not applied systematically to all adult females. One adult (1-G) and one unsexed juvenile (1-C) were the only two individuals with crania to exhibit blunt force cranial trauma, indicating that blunt force cranial trauma was not age-exclusive. All of the individuals who underwent mtDNA analysis (3-B, 3-C, 1-D, and 1-F) were found to have likely been related (Turner et al., 2012). Of this group of individuals known to be related, trauma includes strangulation (3-B and 3-C), cervical blunt force trauma with blunt force pelvic trauma (1-D), and one individual with no evidence of trauma (1-F, who lack crania and cervical vertebrae). This indicates that no specific method of trauma was used systematically across known family members. Further delineation of differing perimortem treatment based on age, sex, or social status using skeletal trauma alone is not possible with a small sample size missing so many crucial elements such as this; other features, not discernable from the available evidence, may also have played a role in the manner of their deaths.

Perimortem Trauma in Context

This study hypothesized that the patterns of perimortem trauma present in the HMC assemblage are consistent with documented forms of violence from the Late Medieval period in Mongolia (**H_2**), specifically either combat-related violence in the form of raiding or warfare (**H_2a**) or more punitive, ritualistic forms of violence reserved for people of high status (**H_3b**). As previously stated, none of the HMC individuals show any evidence of sharp force trauma consistent with the use of projectile or bladed weaponry. This indicates that they were likely not involved in incidences of raiding or warfare as is described in the literature, refuting hypothesis **H_2a**. The individuals in the assemblage do present with injuries such as strangulation and blunt force cranial and cervical trauma that can be considered to be "bloodless" in that they would likely not have resulted in the shedding of blood. Importantly, they are also consistent with "bloodless" modes of violence documented in the historical record, which were more ritualistic in nature and support hypothesis **H_2b**. The exception to this is the involuntary, self-inflicted amputation of the tongue in individuals 1-D and 1-G; this injury would have undoubtedly resulted in bleeding from the mouth, but it is impossible to tell if this was the intended result or a side effect of the forcing of the neck backwards over a bar or rod. That these individuals experienced their perimortem trauma because of their high status is further supported by dietary isotope data from Turner and colleagues (2012) that suggests that the group continued to have access to resources during a period when nutrient stress was widespread. As stated in the background, isotopic data indicates that the HMC individuals did not experience macronutrient stress late in life, maintaining a relatively healthy diet during a period of drought and famine (Turner et al., 2012). To conclude, the

injuries of the HMC individuals are consistent with punitive, ritualistic forms of execution typically reserved for high status individuals described in the historical literature.

The violent deaths of the HMC individuals closely correlate with one of the better documented instances of when the bloodless execution was used on an individual of high status from *The Secret History.* The employment of a bloodless death appears in the retelling of the execution of Jamukha, a high status individual who was Genghis Khan's former spiritual brother (Broadbridge, 2008). Jamukha had become the enemy of his once close ally, Genghis Khan, and was sentenced to death. Just before his execution, he requested, "If you can, my friend, in sending me to my death, please execute me without bloodshed. When I am lying dead and in the earth, our Lofty Mother, my unbreathing dust shall be the guardian of your descendants for centuries to come. Prayerfully do I promise this" (Broadbridge, 2008: 66; de Rachewiltz, 2006). However, a contemporary Persian historian, Rasid al-Din, wrote that Jamukha's request for a bloodless death was not granted and he was instead dismembered while still alive (Drobyshev, 2006; de Rachewiltz, 2006), which would have constituted a violation of this individual's corporeal remains (Drobyshev 2006).

Individuals 1-D and 1-G have injuries that are consistent with trauma to the cervical spine that parallel the documented practice of back-breaking. However, while this treatment is documented as having occurred in the historical record, there is sparse description of the specific method behind the back-breaking practice, specifically the materials used (log, rod, bar, etc.) and the area of the back that is typically broken (cervical, thoracic, or lumbar regions). Additionally, there is little written concerning the

execution of women and children in Medieval Mongolia, and thus it is unknown if the treatment of the adult female (1-D) and of the juveniles is a typical practice in manner and occurrence. Given the method of their perimortem trauma, it is possible that these individuals were of political importance and were caught up in the factional wars following the collapse of the Mongolian Empire and the coincident assassination of Genghis Khan's lineage, or killed bloodlessly as human sacrifices, as mentioned in the background. It is important to note that the factional wars were widespread during this period, whereas the practice of human sacrifice was waning due to the pressure to move away from human sacrifice by the Lamas. While it is not impossible that some or all of the HMC individuals were human sacrifices, killed bloodlessly, it is more likely that they were killed for more political or punitive reasons.

Mortuary Treatment of the HMC Individuals

As previously stated, past studies found that the HMC assemblage were left exposed to the elements following death until their bodies became desiccated, a period during which they were scavenged by birds (Frohlich et al., 2008; Frohlich et al., 2005; Frohlich et al., 2013). After desiccation they were secondarily deposited in the cave. This study hypothesized that the postmortem treatment described is consistent with descriptions of mortuary treatment found in the historical literature (**H_3**), with the mortuary treatment being attributable to Shamanistic (**H_3a**) or Lamaistic practices (**H_3b**), or a combination of the two (**H_3c**).

Mongolian Shamanistic mortuary practices are highly varied and may include any combination of secondary burial, burial in an elevated place, cremation, the inclusion of grave goods, and the inclusion of an animal or human sacrifices (Drobyshev, 2006;

Crubezy et al., 2006). The HMC individuals exhibit strong evidence indicating secondary deposition, however no animal remains were recovered to suggest animal sacrifice and no grave goods were recovered during removal in 2004 (Bazarsad et al., 2005). While it is possible that one or more of the HMC individuals may have been a human sacrifice, killed bloodlessly, there is no available evidence to identify or differentiate between individuals in the assemblage who may have been killed punitively or for political reasons and those who may have been killed sacrificially. Additionally, much of the literature surrounding Shamanistic mortuary practices speaks of the "burial" of the individuals, whether it be in fields or mountains; the HMC individuals do not exhibit evidence of having been buried but were placed in the cave on the mountain, elevated from the surrounding area, after a period of desiccation on the surface. The remains also exhibit evidence of scavenging by birds (Frohlich et al., 2005). This may be evidence of what would have been desecration of the remains following the Shamanistic ideology (de Rachewiltz, 2006; Drobyshev, 2006).

The evaluation of the postmortem treatment of the HMC individuals following a Shamanistic perspective has some conflicting elements; if the placement of these individuals in an elevated place is indicative of high social status, potential desecration of the remains via exposure and subsequent scavenging prior to secondary deposition would be contradictory in the Shamanistic worldview. It is arguable that the bird scavenging may have been part of the punitive actions taken against the HMC individuals, a symbolic postmortem continuation of the potentially punitive methods of perimortem trauma that the individuals experienced. As noted above, the evidence of bloodless methods of execution for the assemblage indicate that they may have been high status;

burial in an elevated place, a practice that the historical record indicates was reserved for high status individuals, would further validate the suggestion that these individuals were of high status. However, I found no information describing the postmortem treatments of individuals killed punitively in the historical record. While the secondary deposition of the remains in the cave is indicative of Shamanistic influences on the HMC assemblage's postmortem treatment, the scavenging by birds, the lack of evidence for sacrifices and grave goods, and the placement rather than burial of the individuals in the cave suggests that the mortuary practices implemented for the assemblage are not completely consistent with the documented mortuary practices following Shamanistic beliefs in Late Medieval Mongolia, indicating that the results neither support nor refute **H_3a**.

As noted above, Lamaism is described in the historical record as involving a mortuary treatment, sky burial, wherein bodies were exposed to the elements and scavengers (Drobyshev, 2006). Sky burials do not include grave goods or sacrifices, and are often identifiable by the presence of scavenging by animals and a lack of evidence of burial in the ground. As previously mentioned, the HMC individuals exhibit soft tissue evidence consistent with scavenging by birds. While possible grave goods were reported by researchers visiting the cave in the 1980s, these were not present at the time of the recovery of the remains in 2004; if these artifacts were present, they were likely removed from the cave by visitors, thus the presence of grave goods is indeterminate (Bazarsad et al., 2005). In sky burials, secondary deposition in an elevated place was not mentioned as being typical, but a rather a distinctly Shamanistic phenomenon (Drobyshev, 2006; Heissig, 1957). The available historical documentation on what happens to human remains following cremation or exposure to scavenging is limited to the discussion of

high status individuals, such as lamas or indigenous leaders, whose remains were sometimes placed in mausoleums (Heissig, 1957). There also is no available information on whether or how mortuary treatment changed for individuals who were punitively killed. Based on this information, the postmortem treatment of the HMC individuals does exhibit some possible Lamaistic influences, however placement of the individuals in a cave on a mountain, an elevated place, marks a divergence from the Lamaistic sky burial practice, indicating that the results neither refute nor support **H_3b**.

The final portion of this hypothesis posits that the postmortem treatment of the HMC individuals may represent a combination of Shamanistic and Lamaistic funerary practices (**H_3c**). The historical record suggests that during the 16th and 17th centuries in Mongolia, to which the assemblage dates, many Mongols converted from Shamanism to Lamaism but retained some Shamanistic practices (Hesse, 1987; Drobyshev, 2006). One of the mortuary practices that persisted included the continuance of placing high-ranking individuals in elevated places (Drobyshev, 2006:83). The combination of evidence consistent with scavenging by birds and secondary deposition in an elevated place suggests that the postmortem treatment of the HMC individuals may represent a hybridization of Shamanistic and Lamaistic mortuary practices. The lack of evidence for grave goods and sacrifices further supports hypothesis **H_3c**. The one possible condition to accepting this hypothesis is that it remains unknown whether and how Shamanistic and Lamaistic mortuary practices were altered in situations in which the deceased were punitively killed.

The combination of Shamanistic and Lamaistic mortuary practices present in the HMC assemblage suggests that these individuals—or those who were responsible for

their funerary treatment, were likely of the group of people who practiced Lamaism but retained aspects of Shamanism. This mixing of practices may be resultant of the remote nature of the Hets Mountain region, where there may have been little religious oversight by the Lamas, but enough involvement to adhere to Lamaistic practices.

CHAPTER VI

CONCLUSION

For this study, the overarching research question was: what was the social identity of the Hets Mountain Cave mummies and what was their social position within contemporary Mongolian society? The results of this study suggest that the HMC assemblage was a group of individuals killed punitively and/or ritualistically in a way consistent with the treatment of high status individuals. Though these individuals exhibit injuries consistent with bloodless death, evidence indicates that the perimortem treatment among the HMC individuals varied in a way that prevents delineation of trauma patterns by sex and age, indicating that other circumstances not visible with the available evidence likely played a role in the manner of their deaths. The exception to this is the oldest adult male (1-G), who was the only individual to exhibit a combination of mortal injuries, to exhibit oral pathologies, and to have possibly been non-local to the region. His unique perimortem treatment may have been linked to his role as the oldest male, a non-local, or both. The bloodless execution of these individuals indicate that this method of killing was not applied consistently and systematically to all people.

The method of bloodless execution of the HMC individuals is consistent with punitive, ritualistic killing of people of high status, such as nobles, ambassadors, and human sacrifices. Due to the pressure from Lamas to move away from human sacrifice as a mortuary practice, it is likely that they were a group of individuals killed in the

factional wars of the period. However, there is little written about executions of women and children; the larger purpose or motivation behind the execution of women and children is unknown.

Based on available evidence, the two-step mortuary treatment of the HMC individuals suggests that they—or whoever was responsible for their burial—may have been some of the many Mongols who converted to Lamaism in the 16th and 17th century but retained some Shamanistic practices. The act of placing the HMC individuals in an elevated place further supports the hypothesis that they were likely of high status. It is possible that the scavenging by birds, lack of burial in the ground, sacrifices, and other grave goods may be consequences of punitively, ritualistically executed individuals. This study highlights the need for further research on the punitive treatment of all individuals, including women and children, as well as the postmortem treatments of individuals punitively killed during this time period to establish any differentiation in burial treatment from non-punitively killed individuals.

Multiple limitations were encountered in this study. The postmortem visitation to the cave and subsequent disarticulation, manipulation, and looting of the assemblage greatly impacted the assessment of trauma patterns among the HMC individuals. Any potential grave goods that may have been present at the time of deposition were also likely lost during these activities, hindering interpretations of the culture significance of their mortuary treatment. While 3D CT scans provide a non-destructive alternative to autopsy, assessment of fine fractures and other micro-trauma was limited due to the resolution produced by the 3D models of the CT scans, as compared to real bone samples.

This study provided a unique opportunity to further our understanding of violence and postmortem treatment during the Late Medieval period in the southern Gobi Desert in Mongolia. The purpose of this study was to identify the social identities of the HMC individuals through the analysis of CT scans, mortuary evidence, and available historical sources, supplemented with evidence and findings from previous analyses. Through these methods, it was determined that the evidence suggests that these individuals were likely of high status, killed punitively or ritualistically, and whose postmortem treatment is consistent with hybridized Shamanistic and Lamaistic mortuary treatment. Embedding the HMC individuals within contextual evidence deepens our understanding of who these individuals were during life, why they were killed, and what the larger purpose of their distinctive mortuary treatment may have been, shedding more light on the experiences of people in a hinterland region and poorly understood yet highly enigmatic phase of history.

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APPENDIX A

HETS MOUNTAIN CAVE MUMMIES INVENTORY AND FRACTURE OBSERVATION SHEETS

-= absent
✓= present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hets Mountain Jaw - Gobi Observer CR

Feature/Burial Number ____/____ Date ____

Burial/Skeleton Number 37 /____

Present Location of Collection ____

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	—	—	Os Coxae		
Scapula			Ilium	✓	✓
Body	—	—	Ischium	✓	✓
Glenoid f.	—	—	Pubis	✓	✓
Patella	✓	—	Acetabulum	✓	✓
Sacrum	✓	✓	Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	✓	✓
C2	✓	✓
C7	✓	✓
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	4/4	4/4
T1-T9	9/9	9/9

Sternum: Manubrium — Body —

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	—
12th	✓	—

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	9/9	2/Ø	Ø/Ø

Series/Burial/Skeleton 3A

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus					
Right Humerus					
Left Radius					
Right Radius					
Left Ulna					
Right Ulna					
Left Femur	✓	✓	✓	✓	
Right Femur	✓	✓	✓	✓	
Left Tibia	✓	✓	✓	✓	
Right Tibia					
Left Fibula					
Right Fibula					
Left Talus					
Right Talus					
Left Calcaneus					
Right Calcaneus					

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	Ø / Ø	Ø / Ø	Ø / Ø
#Metacarpals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Metatarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

Comments:

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 3A

Bone: Ribs 6-9 Side: R / M / L Section: neck

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Extremely irregular fracture lines consistent w/ dry bone.

Bone: Ribs 6 & 7 Side: R / M / L Section: neck

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone

Bone: C1 Side: R / M / L Section: Anterior, between the 2 ossification centers

Description: Dislocation; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: malunion of ossification centers; right oss. center appears angled superiorly

Bone: Rib 2 Side: R / M / L Section: body

Description: Oblique fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone

Observations:

No evidence of ante- or perimortem trauma.

Page 1 of 1

–= absent
✓= present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hets Mountain Cave - Gobi Observer CR

Feature/Burial Number ____/____ Date ____

Burial/Skeleton Number 3B ____/____

Present Location of Collection ____

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	—	—	Os Coxae		
Scapula			Ilium	✓	✓
Body	—	—	Ischium	✓	✓
Glenoid f.	—	—	Pubis	✓	✓
Patella	—	—	Acetabulum	✓	✓
Sacrum	✓	✓	Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	✓	✓
C2	✓	✓
C7	✓	✓
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	4/4	4/4
T1-T9	9/9	9/9

Sternum: Manubrium — Body —

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	✓
12th	✓	✓

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	___/___	___/___	___/___

Series/Burial/Skeleton 3B

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus	—	—	—	—	—
Right Humerus	—	—	—	—	—
Left Radius	—	—	—	—	—
Right Radius	—	—	—	—	—
Left Ulna	—	—	—	—	—
Right Ulna	—	—	—	—	—
Left Femur	✓	✓	✓	✓	✓
Right Femur	✓	✓	✓	✓	✓
Left Tibia	✓	✓	✓	✓	✓
Right Tibia	✓	✓	✓	✓	✓
Left Fibula	✓	✓	✓	✓	✓
Right Fibula	✓	✓	✓	✓	✓
Left Talus	✓				
Right Talus	✓				
Left Calcaneus	✓				
Right Calcaneus	✓				

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	Ø / Ø	Ø / Ø	Ø / Ø
#Metacarpals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	Ø / Ø	5 / 5	Ø / Ø
#Metatarsals	Ø / Ø	5 / 5	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

Comments: R leg not present in pictures from Frohlich

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 38

Bone: Ribs 2-6 Side: R / M / L Section: midshaft

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Extremely irregular fracture lines consistent w/ dry bone.

Bone: Rib 1&7 Side: R / M / L Section: neck

Description: Oblique fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone

Bone: Rib 2-6 Side: R / M / L Section: midshaft

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone.

Bone: Tibia Side: R / M / L Section: prox. diaphysis

Description: Crush fracture; direct trauma - blunt force

Estimated timing: antemortem / perimortem / postmortem

Comment: Cancellous bone effected; bone fragments missing; no depression or radiating fracture lines; fracture is severe irregular; no soft tissue present in effected area

Observations:

Soft tissue shows evidence of strangulation - cord embedded in soft tissue around neck.

No evidence of ante- or perimortem skeletal trauma.

Page 1 of 1

—=absent
✓=present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hetz Mountain Cave - Yolo Observer CR

Feature/Burial Number ____/____ Date ____

Burial/Skeleton Number 20 /____

Present Location of Collection ____

CRANIAL BONES AND JOINT SURFACES

	L(left)	R(right)
Frontal	—	—
Parietal	—	—
Occipital	—	—
Temporal	—	—
TMJ	—	—

	L	R
Sphenoid	—	—
Zygomatic	—	—
Maxilla	—	—
Palatine	—	—
Mandible	—	—

POSTCRANIAL BONES AND JOINT SURFACES

	L	R
Clavicle	✓	✓
Scapula		
Body	✓	✓
Glenoid f.	✓	✓
Patella	—	—
Sacrum	✓	✓

	L	R
Os Coxae		
Ilium	✓	✓
Ischium	✓	✓
Pubis	✓	✓
Acetabulum	✓	✓
Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	✓	✓
C2	✓	✓
C7	✓	✓
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	4/4	4/4
T1-T9	9/9	9/9

Sternum: Manubrium ✓ Body ✓

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	✓
12th	✓	—

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	9/9	8/9	0/0

Series/Burial/Skeleton 3C

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus					
Right Humerus	✓	✓	✓	✓	✓
Left Radius					
Right Radius					
Left Ulna					
Right Ulna	✓	✓	✓	✓	✓
Left Femur					
Right Femur	✓	✓	✓	✓	
Left Tibia					
Right Tibia					
Left Fibula					
Right Fibula					
Left Talus					
Right Talus					
Left Calcaneus					
Right Calcaneus					

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	Ø / Ø	Ø / Ø	Ø / Ø
#Metacarpals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Metatarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

Comments: Some pics from Frohlich slow L humerus, but not present in CTs.

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 3C

Bone: C1 Side: R / M / L Section: Inferior synovial joint

Description: Dislocation; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: C1 intact, but displaced from vertebral column.

Bone: Ulna Side: R / M / L Section: distal

Description: Crush fracture; direct trauma - blunt force

Estimated timing: antemortem / perimortem / postmortem

Comment: Cancellous bone affected; bone fragments in ulna; fracture lines irregular - consistent w/ dry bone; no protective soft tissue present

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Observations:

Soft tissue shows evidence of strangulation; rope found around neck in situ

No evidence of ante or perimortem skeletal trauma.

Page 1 of 1

— = absent
✓ = present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hets Mountain Cave - Holy Observer CR

Feature/Burial Number ____/____ Date ____

Burial/Skeleton Number 1A/____

Present Location of Collection ____

CRANIAL BONES AND JOINT SURFACES

	L(left)	R(right)
Frontal	—	—
Parietal	—	—
Occipital	—	—
Temporal	—	—
TMJ	—	—

	L	R
Sphenoid	—	—
Zygomatic	—	—
Maxilla	—	—
Palatine	—	—
Mandible	—	—

POSTCRANIAL BONES AND JOINT SURFACES

	L	R
Clavicle	—	—
Scapula		
Body	—	—
Glenoid f.	—	—
Patella	—	—
Sacrum	✓	✓

	L	R
Os Coxae		
Ilium	✓	✓
Ischium	✓	✓
Pubis	✓	✓
Acetabulum	✓	✓
Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	—	—
C2	—	—
C7	✓	✓
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	Ø/Ø	Ø/Ø
T1-T9	9/9	9/9

Sternum: Manubrium — Body —

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	✓
12th	✓	✓

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	9/5	8/10	0/0

Series/Burial/Skeleton 1-A

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus					
Right Humerus					
Left Radius					
Right Radius					
Left Ulna					
Right Ulna					
Left Femur	✓	✓	✓	✓	✓
Right Femur	✓	✓	✓	✓	✓
Left Tibia					
Right Tibia					
Left Fibula					
Right Fibula					
Left Talus					
Right Talus					
Left Calcaneus					
Right Calcaneus					

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	__/__	__/__	__/__
#Metacarpals	__/__	__/__	__/__
#Phalanges	__/__	__/__	__/__

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	__/__	__/__	__/__
#Metatarsals	__/__	__/__	__/__
#Phalanges	__/__	__/__	__/__

Comments: Distal femurs out of CT frame.

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1A

Bone: Ribs 2-5 Side: R / M / (L) Section: angle

Description: Oblique fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines w/ splintering consistent w/ dry bone

Bone: Ribs 2 & 3 Side: (R) / M / L Section: angle

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone

Bone: Ribs 4, 5, & 8 Side: (R) / M / L Section: angle

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone

Bone: Rib 4 Side: (R) / M / L Section: body

Description: Likely transverse; direct trauma - blunt force

Estimated timing: antemortem / perimortem / postmortem

Comment: No distinct fracture line visible; injury largely remodeled - callus still 'somewhat' visible

Bone: Rib 1e Side: R / M / (L) Section: neck

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture line w/ splintering consistent w/ dry bone

Page 1 of 2

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1A

Bone: C7 Side: R / (M) / L Section: spinous process

Description: Oblique; indirect trauma

Estimated timing: antemortem / perimortem / (postmortem)

Comment: Spinous process only aspect of vertebrae present; irregular fracture line consistent w/ dry bone fracture.

Bone: Rib 5 Side: R / M / (L) Section: body

Description: Oblique fracture; indirect trauma

Estimated timing: antemortem / perimortem / (postmortem)

Comment: irregular fracture line consistent w/ dry bone

Bone: Rib 8 Side: R / M / (L) Section: angle

Description: Likely transverse; direct trauma - blunt force

Estimated timing: (antemortem) / perimortem / postmortem

Comment: No distinct fracture line visible due to remodeling. Callus visible. Osteophyte present on cranial edge.

Bone: Side: R / M / L Section:

Description:

Estimated timing: antemortem / perimortem / postmortem

Comment:

Observations:

No evidence of perimortem trauma.

Page 2 of 2

– = absent
✓ = present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hets Mountain Cave - Gold / Observer CR

Feature/Burial Number ____ / ____ Date ____

Burial/Skeleton Number 1F / ____

Present Location of Collection ____

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	–	–	Os Coxae		
Scapula			Ilium	✓	✓
Body	–	–	Ischium	✓	✓
Glenoid f.	–	–	Pubis	✓	✓
Patella	✓	–	Acetabulum	✓	✓
Sacrum	✓	✓	Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	–	–
C2	–	–
C7	✓	✓
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	0 / 0	0 / 0
T1-T9	9 / 9	9 / 9

Sternum: Manubrium – Body –

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	–
12th	✓	–

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	2 / 2	2 / 2	0 / 0

Series/Burial/Skeleton 1B

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus					
Right Humerus					
Left Radius					
Right Radius					
Left Ulna					
Right Ulna					
Left Femur	✓	✓	✓	✓	✓
Right Femur	✓	✓	✓	✓	✓
Left Tibia	✓	✓	✓	✓	✓
Right Tibia					
Left Fibula	✓	✓	✓	✓	✓
Right Fibula					
Left Talus					
Right Talus					
Left Calcaneus					
Right Calcaneus					

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	0/0	0/0	0/0
#Metacarpals	0/0	0/0	0/0
#Phalanges	0/0	0/0	0/0

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	0/0	0/0	0/0
#Metatarsals	0/0	0/0	0/0
#Phalanges	0/0	0/0	0/0

Comments: Sacralization of L5

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1B

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Observations:

No visible fractures.

Page 1 of 1

– = absent
✓ = present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hots Mountain Cave - Gobi / Observer CR

Feature/Burial Number ____ / ____ Date ____

Burial/Skeleton Number 1-C / ____

Present Location of Collection ____

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	✓	–	Os Coxae		
Scapula			Ilium	✓	✓
Body	✓	✓	Ischium	✓	✓
Glenoid f.	✓	✓	Pubis	✓	✓
Patella	–	✓	Acetabulum	✓	✓
Sacrum	✓	✓	Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	✓	✓
C2	✓	✓
C7	✓	✓
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	4/4	4/4
T1-T9	9/9	9/9

Sternum: Manubrium ✓ Body ✓

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	✓
12th	✓	✓

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	8/8	8/8	0/0

Series/Burial/Skeleton 1-C

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus	✓	✓	✓	✓	✓
Right Humerus	—	—	—	—	—
Left Radius	—	—	—	—	—
Right Radius	—	—	—	—	—
Left Ulna	—	—	—	—	—
Right Ulna	—	—	—	—	—
Left Femur	✓	✓	✓	✓	✓
Right Femur	✓	✓	✓	✓	✓
Left Tibia	✓	✓	✓	✓	✓
Right Tibia	✓	✓	✓	✓	✓
Left Fibula	✓	✓	✓	✓	✓
Right Fibula	✓	✓	✓	✓	✓
Left Talus	✓				
Right Talus	✓				
Left Calcaneus	✓				
Right Calcaneus	✓				

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	Ø / Ø	Ø / Ø	Ø / Ø
#Metacarpals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	5 / 5	5 / 5	Ø / Ø
#Metatarsals	5 / 5	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

Comments:

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1C

Bone: Frontal Side: R / M / L Section: Above L orbit

Description: linear fracture; direct trauma - blunt force

Estimated timing: antemortem / perimortem / postmortem

Comment: single fracture line radiating superiorly from above L orbit; no observed depression.

Bone: Frontal Side: R / M / L Section: R orbital plate

Description: penetrating fracture; direct trauma - sharp force

Estimated timing: antemortem / perimortem / postmortem

Comment: crescent-shaped complete puncture w/ vert. irregular edges consistent w/ thin, dry bone.

Bone: Parietal Side: R / M / L Section: Anterior-inferior quadrant

Description: linear fracture; direct trauma - blunt force

Estimated timing: antemortem / perimortem / postmortem

Comment: four fracture lines radiating from single point; no observed depression. Likely postmortem bone loss between fracture line & squamosal suture.

Bone: humerus Side: R / M / L Section: lateral epicondyle

Description: crush fracture; direct trauma - blunt force

Estimated timing: antemortem / perimortem / postmortem

Comment: no depression or radiating fracture lines visible; fracture line seems irregular; bone fragments missing

Observations:

No evidence of antemortem trauma.

Page 1 of 1

– = absent
✓ = present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hets Mountain Cave - Gobi / Observer CR

Feature/Burial Number ____ / ____ Date ____

Burial/Skeleton Number 1-D / ____

Present Location of Collection ____

CRANIAL BONES AND JOINT SURFACES

	L(left)	R(right)
Frontal	✓	✓
Parietal	✓	✓
Occipital	✓	✓
Temporal	✓	✓
TMJ	✓	✓

	L	R
Sphenoid	✓	✓
Zygomatic	✓	✓
Maxilla	✓	✓
Palatine	✓	✓
Mandible	✓	✓

POSTCRANIAL BONES AND JOINT SURFACES

	L	R
Clavicle	✓	✓
Scapula		
Body	–	–
Glenoid f.	–	–
Patella	–	–
Sacrum	✓	✓

	L	R
Os Coxae		
Ilium	✓	✓
Ischium	✓	✓
Pubis	✓	✓
Acetabulum	✓	✓
Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	✓	✓
C2	✓	✓
C7	✓	✓
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	4/4	4/4
T1-T9	9/9	9/9

Sternum: Manubrium ✓ Body ✓

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	✓
12th	✓	✓

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	8/8	8/8	0/0

Series/Burial/Skeleton 1-D

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus					
Right Humerus					
Left Radius					
Right Radius					
Left Ulna					
Right Ulna					
Left Femur					
Right Femur	✓	✓	✓	✓	✓
Left Tibia					
Right Tibia					
Left Fibula					
Right Fibula					
Left Talus					
Right Talus					
Left Calcaneus					
Right Calcaneus					

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	Ø / Ø	Ø / Ø	Ø / Ø
#Metacarpals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Metatarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

Comments:

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1D

Bone: Parietal Side: R / M / (L) Section: body

Description: Penetrating fracture; direct trauma - sharp force

Estimated timing: antemortem / perimortem / (postmortem)

Comment: complete puncture; slight crushing at fracture edge; no obvious beveling, depression, or radiating fracture lines.

Bone: C4-6 Side: R / (M) / L Section: Vertebral arch

Description: Crush - compression; direct trauma - blunt force

Estimated timing: antemortem / (perimortem) / postmortem

Comment: crushing to the spinous processes; crush to the vertebral arch from contact w/ other vertebrae.

Bone: Rib 5 Side: (R) / M / L Section: body

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / (postmortem)

Comment: Irregular fracture line consistent w/ dry bone.

Bone: Rib 2 Side: R / M / (L) Section: angle

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / (postmortem)

Comment: Irregular fracture line consistent w/ dry bone.

Bone: Coccyx Side: R / (M) / L Section: sacral articulation

Description: Dislocation; indirect trauma

Estimated timing: antemortem / (perimortem) / postmortem

Comment: Malunion w/ sacrum; coccyx attached but at near right angle with sacrum. Soft tissue present at joint.

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Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1D

Bone: T5 Side: R / M / L Section: spinous process

Description: Transverse fracture; direct trauma - blunt force

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture line consistent w/ dry bone.

Bone: Ribs 3 & 4 Side: R / M / L Section: Angle

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone.

Bone: maxilla Side: R / M / L Section: Superior to R central incisor

Description: penetrating fracture; direct trauma - sharp force

Estimated timing: antemortem / perimortem / postmortem

Comment: Incomplete puncture; no depression or radiating fracture lines; Irregular fracture circumference consistent w/ dry bone

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Observations:

No evidence of antemortem trauma.

Tongue severed along arch of dental arcade

– = absent
✓ = present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Heta Mountain Cave - Unit 1 Observer CR

Feature/Burial Number ____/____ Date ____

Burial/Skeleton Number 1F /____

Present Location of Collection ____

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	–	–	Os Coxae		
Scapula			Ilium	✓	✓
Body	–	–	Ischium	✓	✓
Glenoid f.	–	✓	Pubis	✓	✓
Patella	–	✓	Acetabulum	✓	✓
Sacrum	–	–	Auric. Surface	✓	–

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	–	–
C2	–	–
C7	–	–
T10	✓	✓
T11	✓	✓
T12	✓	✓
L1	✓	✓
L2	✓	✓
L3	✓	✓
L4	✓	✓
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	0/0	0/0
T1-T9	9/9	9/9

Sternum: Manubrium – Body –

RIBS (individual)

	L	R
1st	✓	✓
2nd	✓	✓
11th	✓	✓
12th	✓	–

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	9/9	9/9	0/0

Series/Burial/Skeleton 1F

Observer/Date CR

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus	—	—	—	—	—
Right Humerus	—	—	—	—	—
Left Radius	—	—	—	—	—
Right Radius	—	—	—	—	—
Left Ulna	—	—	—	—	—
Right Ulna	—	—	—	—	—
Left Femur	✓	✓	✓	✓	✓
Right Femur	✓	✓	✓	✓	✓
Left Tibia	—	—	—	—	—
Right Tibia	✓	✓	✓	✓	✓
Left Fibula	—	—	—	—	—
Right Fibula	✓	✓	✓	✓	✓
Left Talus	—				
Right Talus	—				
Left Calcaneus	—				
Right Calcaneus	—				

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	Ø / Ø	Ø / Ø	Ø / Ø
#Metacarpals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Metatarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

Comments: R foot present in pics, but absent in scans.

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1F

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Observations:

No visible fractures.

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– = absent
✓ = present

INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Hets Mountain Cave - Mobi Observer CR

Feature/Burial Number ____ / ____ Date ____

Burial/Skeleton Number 1-G1 / (1-E + 1-A/D)

Present Location of Collection ____

CRANIAL BONES AND JOINT SURFACES

	L(left)	R(right)
Frontal	✓	✓
Parietal	✓	✓
Occipital	✓	✓
Temporal	✓	✓
TMJ	✓	✓

	L	R
Sphenoid	✓	✓
Zygomatic	✓	✓
Maxilla	✓	✓
Palatine	✓	✓
Mandible	✓	✓

POSTCRANIAL BONES AND JOINT SURFACES

	L	R
Clavicle	✓	✓
Scapula		
Body	–	✓
Glenoid f.	–	✓
Patella	–	–
Sacrum	✓	✓

	L	R
Os Coxae		
Ilium	✓	✓
Ischium	✓	✓
Pubis	✓	✓
Acetabulum	✓	✓
Auric. Surface	✓	✓

VERTEBRAE (individual)

	Centrum	Neural Arch
C1	✓	✓
C2	✓	✓
C7	✓	✓
T10	–	–
T11	–	–
T12	–	–
L1	–	–
L2	–	–
L3	–	–
L4	–	–
L5	✓	✓

VERTEBRAE (grouped)

#Present/# Complete

	Centra	Neural Arches
C3-6	4/4	4/4
T1-T9	3/3	3/3

Sternum: Manubrium ✓ Body ✓

RIBS (individual)

	L	R
1st	–	✓
2nd	–	✓
11th	–	–
12th	–	–

RIBS (grouped)

#Present/# Complete

	L	R	Unsided
3-10	Ø/Ø	9/5	Ø/Ø

Series/Burial/Skeleton 1-21

Observer/Date CD

LONG BONES

	Proximal Epiphysis	Diaphysis: Proximal Third	Diaphysis: Middle Third	Diaphysis: Distal Third	Distal Epiphysis
Left Humerus	—	—	—	—	—
Right Humerus	✓	✓	✓	✓	✓
Left Radius	—	—	—	—	—
Right Radius	—	—	—	—	—
Left Ulna	—	—	—	—	—
Right Ulna	—	—	—	—	—
Left Femur	✓	✓	—	—	—
Right Femur	✓	✓	—	—	—
Left Tibia	—	—	—	—	—
Right Tibia	—	—	—	—	—
Left Fibula	—	—	—	—	—
Right Fibula	—	—	—	—	—
Left Talus —					
Right Talus —					
Left Calcaneus —					
Right Calcaneus —					

HAND (# Present/# Complete)

	L	R	Unsided
# Carpals	Ø / Ø	Ø / Ø	Ø / Ø
#Metacarpals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

FOOT (# Present/# Complete)

	L	R	Unsided
#Tarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Metatarsals	Ø / Ø	Ø / Ø	Ø / Ø
#Phalanges	Ø / Ø	Ø / Ø	Ø / Ø

Comments: CT scans of 1-F & 1-A/D are combined to create 1-Y.

CT of 1-A/D only shows pelvic area, including L5 & proximal femurs

Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1G

Bone: Frontal Side: R / (M) / L Section: lateral to R orbit

Description: Penetrating; direct trauma - sharp force

Estimated timing: antemortem / perimortem / (postmortem)

Comment: Complete puncture. Irregular edges consistent w/ dry bone. No depression, evidence of beveling, or radiating fracture lines.

Bone: Parietals Side: (R) / M / (L) Section: see comment

Description: linear fracture; direct trauma - blunt force

Estimated timing: antemortem / (perimortem) / postmortem

Comment: Single fracture line extends from the body of R parietal to frontal angle, then along the coronal suture of the L parietal. No signs of depression

Bone: C3-5 Side: R / (M) / L Section: vertebral arch

Description: Crush - compression; direct trauma - blunt force

Estimated timing: antemortem / (perimortem) / postmortem

Comment: crushing of the spinous processes; crush to the vertebral arch from contact w/ other vertebrae.

Bone: Scapula Side: R / M / L Section: medial border

Description: Crush; direct trauma - blunt force

Estimated timing: antemortem / perimortem / (postmortem)

Comment: Very irregular fracture line consistent w/ dry bone

Bone: Nasal Side: (R) / M / L Section: nonarticular inferior edge

Description: linear fracture; direct trauma - blunt force

Estimated timing: (antemortem) / perimortem / postmortem

Comment: fracture line somewhat visible; callus formation & remodeling visible. Bone fragment missing along inferior edge

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Hets Mountain Cave Collection

Fracture Observation Form

Skeleton 1G

Bone: Ribs 5, 6, & 8 Side: (R) / M / L Section: angle

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / postmortem

Comment: Irregular fracture lines consistent w/ dry bone

Bone: Rib 9 Side: (R) / M / L Section: midshaft

Description: Spiral fracture; indirect trauma

Estimated timing: antemortem / perimortem / (postmortem)

Comment: Irregular fracture line consistent w/ dry bone

Bone: Ilium Side: (R) / M / L Section: sacro-iliac joint

Description: Dislocation; indirect trauma

Estimated timing: antemortem / perimortem / (postmortem)

Comment: No injury to the joint surfaces, no protective soft tissue to hold the joint together. malunion w/ sacrum.

Bone: _____ Side: R / M / L Section: _____

Description: _____

Estimated timing: antemortem / perimortem / postmortem

Comment: _____

Observations:

Cord found around neck in situ.

Tongue severed along curve of dental arcade