Late Bronze Age Skeletal Populations of Slovenia

Jayne-Leigh Thomas

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ABSTRACT

Within the field of archaeology, cremation studies have the potential to provide important information regarding regional demography, pyre technology, burial rituals, and social rites. The development of recognized value and study of cremated remains has been stimulated by the establishment of proper methods of analysis and the increased awareness of the varying characteristics the bones exhibit after having been exposed to firing. During the Late Bronze Age, cremation was the principal method of disposing of deceased individuals throughout central and southern Europe. Three Urnfield Culture sites which had the most preserved material were selected for this study; from these sites, 169 individuals were selected for osteoarchaeological research. In addition to a standard osteological examination, cremation-related changes to the skeleton were studied such as temperature of firing, fracture patterns, element survival, and overall fragmentation and preservation. Demographics such as age and sex were established for each individual when possible and any animal bones present were acknowledged. This research is important because it is the first major osteological study done on cremated remains from Urnfield Culture sites in Slovenia. It is bringing to light new information on population demographics, the effectiveness of the cremation process during the time of the Urnfield Culture, and will supplement current research on the Late Bronze Age in Slovenia.

DECLARATION

I hereby declare that this thesis is my own work and was written by myself. I confirm that all other sources that have been used have been cited and acknowledged within the abstract and text.

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Jayne-Leigh Thomas

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For my Lord in Heaven – Psalm, 56:3 – May I never forget.

"If you have built castles in the air, your work need not be lost; that is where they should be. Now put the foundations under them." ~Henry David Thoreau.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

While often discarded, ignored, or considered an insignificant archaeological resource, cremated remains have the potential to provide archaeologists with information regarding regional demography, pyre technology, burial rituals, and social rites that otherwise would not be obtainable. In many periods, the process of cremation is the only visible burial practice from a specific region and archaeologists can ascertain details about ancient funerary practices by analyzing the temperature of firing and studying the weights of cremated remains (Dzierzykray-Rogalski, 1966: 41; Mays, 1998: 216; McKinley & Bond, 2001: 281). Despite obvious limitations to studying cremated bones, failing to recognize the prospective data which could be acquired from burned remains means a loss of information regarding population demographics, pathologies, and trends in funerary technologies (Lisowski, 1968: 76; McKinley, 1997b: 129, 132; Mays, 1998: 216).

During the Late Bronze Age (LBA), which lasted approximately from 1300 B.C. to 750 B.C., cremation was the primary method of disposing of deceased individuals throughout central and southern Europe. This cultural phase is referred to as the Urnfield Culture; deceased individuals would be placed on a pyre, cremated, and then the remains would be placed into an urn before being buried in an agricultural field. Urnfield Culture cemeteries uncovered have revealed clusters of urns buried together in hundreds, and often thousands, of graves. Graves generally contained one or more ceramic vessels containing the burned remains of the deceased and objects of personal adornment such as fibulae or bronze pins (Bogucki, 2004: 87).

Between 1952 and 1993, cremated remains were recovered from three archaeological sites in the Styrian region of Eastern Slovenia. These sites were Ruše, Brinjeva gora, and Pobrežje. The cremations were assigned from the Urnfield Culture due to the presence of specific artifacts within the graves and the associated funerary method. Following excavation, remains were removed from the urns and taken to the Regional Museum of Maribor in Maribor, Slovenia for curation.

It is acknowledged that several extensive works have been completed regarding the interpretation of Urnfield Culture sites in Slovenia; however finds of cremated bone have been mentioned only briefly in publications regarding settlements and pottery analysis. These comments are limited to an overall description such as “burned bone” and as there has been no large-scale osteological study or analysis of the cremated remains from such sites, a large amount of mortuary information has not been discussed.

This, however, is not an uncommon situation. Despite present day cremation studies having been developed during the early 20th century, the osteological analyses of burned remains was not widely adopted until recently, and in many cases, is still not incorporated into archaeological site analyses. It was generally thought that little to no information could be obtained from cremated remains, and in many certain situations, funding was not made available for an osteological study.

The development of recognized value and study of cremated remains has been stimulated by the establishment of proper methods of analysis and the increased awareness of the varying characteristics the bones exhibit after having been exposed to firing. From cremated remains, not only can a demographic profile for the population under study be established, but information such as maximum pyre temperature, length of time of burning, and position of the body on the pyre in relation to direct heat and flame can be obtained. The aim of this thesis is to collect all demographic data from an assemblage of cremated remains from Slovenia in addition to collecting information which will increase the body of available data related to mortuary practices and the burial rites of the Urnfield Culture in Slovenia.

Permission was granted from the University of Ljubljana archaeology department and the Regional Museum of Maribor to study and analyze the remains from three Urnfield Culture sites in Slovenia. The author performed an osteological analysis on the cremated remains from three Late Bronze Age sites from the Styrian region of eastern Slovenia. After the initial osteological analysis of cremated remains from over 160 graves, a comparative study was completed; this included age and sex of the individuals, pathologies, fracture patterns, degrees of coloration, shrinkage, fragment survival, and the efficiency of the cremation process from all three sites. Samples were taken from each site for future radiocarbon dating. Any animal bones found in this analysis were included in the research.

This research is important because it is the first major osteological study done on cremated remains from Urnfield Culture sites in Slovenia. It is bringing to light new information on population demographics, the effectiveness of the cremation process during the time of the Urnfield Culture, and will supplement current research on the Late Bronze Age in Slovenia. For this project, several objectives have been formulated which are outlined below:

Provide a comprehensive review of replicative cremation studies and the effects of firing on bone

Present a detailed synopsis of Slovenian archaeology as it pertains to the Late Bronze Age and a discussion of relevant osteological studies

Discuss standard osteological methods, their limitations, and how they pertain to this specific research

Discuss standard methods of cremation analysis, potential limitations, and their application in this study

Perform an osteological analysis on the remains from several Late Bronze Age sites while investigating firing-related changes to the bone assemblages

Present the results of the osteological study and discuss the findings between the three Slovenian sites with other cremation studies

Within the scope of this study, there are several research topics which the osteological analysis aims to address:

Proportion of males to females that will provide information regarding population demographics

Age distribution of the individuals that will provide demographic information and indicate potential bias in burial patterns

Prevalence of pathological lesions or signs of trauma that will provide information on the health and structure of the population

Potential bias in bone fragment selection

Overall burning patterns that may reveal information about position of the body on the pyre

Range of temperatures reached will show the efficiency of the cremation process

Distribution of fracture patterns that will reveal condition of the body prior to burning

Variation in cremation-related features between sites

Frequency of animal bones included in the cremations

This dissertation will address these inquiries through a review of the relevant literature joined with an in-depth analysis of the burned remains and their cremation-related features.

It continues in chapter II with a discussion of cremation-related topics such as temperature of firing, shrinkage rates, and fracture patterns. Chapter III discusses the study area, relevant osteological reports, and provides a synopsis of the Late Bronze Age in the Styrian region of eastern Slovenia. This chapter has been included to provide the archaeological background for the area under study and discuss the current progress regarding osteological research during the LBA in Slovenia. Chapter IV describes the sample population and examines the methods of ageing and sexing used for the osteological analysis in addition to the modern techniques used when analyzing a cremation. Chapter V presents the data collected on each cremation from the analyzed sites. Chapter VI includes the results acquired from the comparative analysis of the data in addition to a discussion about the results. Chapter VII concludes this research by providing a summary of the work and discussing ideas and plans for future research.

CHAPTER II

CREMATION PRACTICE AND TECHNOLOGY

2.1 Cremation Technology

The word “cremate” comes from the Latin *cremare*, meaning to consume by fire...or to reduce (a body) to ashes” (McKinley, 2000: 404). Archaeologically speaking, the process of cremation is a ritualized act of disposing of the deceased, involving the deliberate burning of the body and subsequent burial or treatment of the remaining bone fragments (McKinley, 1997a: 55). It is a specific funerary practice that connects the living with the dead and reflects the social view of how the deceased were perceived and remembered (Williams, 2004b: 419; Liston, 2007: 57-58). According to Williams, cremation rituals serve to transform, fragment, and reconfigure the material identity of the dead while mediating relationships between living people and their ancestors (2004b: 420).

Williams (2004a) states that “the widespread and varied practices employed in cremating the dead found in many prehistoric and early historic cultures provide a rich set of data to investigate the mnemonic agency of bodies and bones” (Williams, 2004a: 268). He explains that the process of cremation involves not only altering the state of the materials burned, but transforming and fragmenting the entirety of the people, animals, artifacts, and pyre material (Williams, 2004a: 273). He further explicates that the process of cremating an individual provides not only a ritualized performance aimed at altering a personality known to the mourning community, but creates a memorable and distinctive performance due to the variability of the human body and the pyre materials selected for combustion (Williams, 2004a: 273).

Merbs (1967) suggests four major lines of evidence that should be considered by all archaeologists studying cremated human remains. The first category discusses cultural patterning which entails descriptions of burial practices as cultural traits, such as condition of the body upon cremation, the kind of wood used in the funerary pyre, the heat of the fire, and the deposition of ashes and associated grave goods (Merbs, 1967: 498). Merbs' second category considers socio-cultural reconstruction; this category outlines any differential treatment of individuals according to age and/or sex with regard to the mortuary practice and social organization (Merbs, 1967: 498). His third subset of studies outlines biological distance where the archaeologist compares different "populations" of cremated individuals with one another in order to estimate a degree of relatedness (Merbs, 1967: 498). The final category details population studies where the researcher, having recovered all or nearly all of the individuals from a specific population and period in time, is able to analyze population profiles and patterning regarding age, sex, growth, and pathologies (Merbs, 1967: 498).

While the categories established by Merbs can provide informative detail regarding demographics and burial rites, they may prove to be extremely limited based on how the remains are acquired by the researcher and the level of information known about the excavation. In instances where remains are analyzed several years or decades after discovery, it may be difficult to acquire necessary data regarding the recovery of the cremations. The type of wood used in the funerary pyres would not be known unless small fragments survive burning and/or charcoal fragments are included in the assemblage of cremated remains. The condition of the body is unlikely to be known unless information is provided from ethnographic studies or personal communication. It is possible that social organization and the treatment of individuals based on gender or age could be analyzed, provided that such information can be gleaned from the remains and that a map of the cemetery and the location of each grave can be obtained.

In terms of comparing various populations of cremated remains or overall population profiling, the degree of information resulting from the comparison would directly relate to the degree of information acquired from the analysis of a single population. A sample population that lacked the bones from which age, sex, or pathologies could be obtained would be able to provide very little in terms of socio-cultural information or biological profiling, especially when compared to other populations.

2.2 Historical and Ethnographic References

Historical References

An important aspect of cremation studies involves the understanding of the range of cremation practices throughout history. By analyzing past cremation techniques, osteologists can make interpretations based on the evidence within an assemblage of burned remains. For many of these, archaeologists must rely on historical references or ethnographic reports.

In Homer's Iliad, written in the 8th century BC, the writer explains the process of disposing of the deceased by cremation in Ancient Greece. Despite social standing within the community, all individuals were cremated. After construction of a wooden pyre, the body was placed on the pyre, and the pyre was lit. After the body was reduced to ashes, the bones were placed into a vessel or box and buried under a mound or barrow (Lang, 2008: 86-87).

More specifically, details are included regarding the funerary treatment of a high-ranking warrior. A 100 square foot pyre was created using oak logs and numerous animals, including dogs, horses, cattle, and sheep, were slaughtered and placed around the body on top of the pyre (trans. Butler, 2004: 252; McKinley, 1994b: 79). Jars of honey and oil were placed around the body and wine was poured onto the pyre as the flames died out; then the bones of the deceased were carefully separated from the animal bones, placed in an urn, and buried under a barrow (trans. Butler, 2004: 253).

The accounts taken from this book illustrate the energy and resources that were utilized in the funerary process in ancient Greece. While it is important to note the incorporation of sacrificed animals and gift offerings, it is unlikely that elaborate cremation ceremonies took place regularly. Individuals may have had personal items buried with their remains but sacrifices and lavish offerings may have been included only for the funerals of individuals of high social status.

In 932 AD, Arabian explorer Ibn Fadlan witnessed the cremation of a Viking chieftain in a ship on the banks of the Volga River and detailed the events prior to and after burning of the deceased (Sigvallius, 2005: 415). Rich clothes, food, drink, animals, and a slave girl were included as grave goods in the chieftain's funerary ceremony (McKinley, 1994b: 79). It is discussed that interpreting the size and type of boat can be difficult if the boat was placed on the pyre and subsequently burned to ashes (Sigvallius, 2005: 414).

It may be easier to contend that a boat or ship was included in a cremation ceremony if metal nails or rivets are found with the burned remains; however if a boat is only constructed of wood or ropes, nothing will remain once fired (Sigvallius, 2005: 414-415).

In the Old English epic poem *Beowulf*, the burning of the body after death is seen as an element of the purification process and one of spiritual release with 'immediate' transformation. The protagonist is cremated on a large funerary pyre amidst the lamentations of his fellow warriors and it is discussed that as the skeleton was consumed by flames, Heaven swallowed the smoke of the deceased (McKinley, 1994b: 79; McKinley, 2005: 9).

Hiatt's (1969) report on cremation practices in Australia includes information from G. A. Robinson's 19th century ethnographic accounts of Tasmania. Robinson reports that occasionally after the death of an individual, the arms and legs of the deceased would be bound before placement on the pyre. Sometimes the body would be placed in a sitting position rather than bound before being left unattended to burn. As a result, there were small areas of the body were not consumed by the flames. If the corpse did not completely burn during the initial firing, the remains would be raked into a pile and burned again (Hiatt, 1969: 105). After the cremation process was complete, bones would then be collected and buried under a mound of grass and sticks or pulverized and carried in skin bags by family members as amulets. Fine bone dust would often be rubbed on the skin of relatives as a mourning cosmetic (Hiatt, 1969: 105).

Hiatt's article includes summaries of other ethnographic reports from other explorers within mainland Australia. These reports include details regarding deceased individuals being placed into hollow trees and then burned after a substantial period of time and the collection of calcined teeth for ornamental purposes (Hiatt, 1969: 109; Lang, 2008: 89).

Despite the information gathered and presented in historical and ethnographic accounts, researchers must take care not to place too much credibility on such resources. Such accounts can be considered anecdotal especially if they are the only surviving records from a culture or time period. It is also likely that such accounts represent only the funerary practices for the higher ranking individuals rather than the ordinary people of a society.

Ancient Cremation Practices

The basic methods of cremation are essentially the same as those used today. As with historical and ethnographic references, researchers can make comparisons of burial information found in various archaeological sites to infer and reconstruct the mortuary practices and social rites of various cultures throughout the world.

Within ancient Rome, cremation was an important part of the funerary process. The deceased would be carried from their house in a procession to a place on the outskirts of the city, where he or she would be burned on a pyre until the body was reduced to ashes (Noy, 2000: 186; Noy, 2005: 367). The pyres were built in the open over a shallow pit that would have aided the circulation of air (McKinley, 1997b: 132; Noy, 2005: 367). The size of the pyres reflected the status of the individual and papyrus and incense were added to help with combustion (Noy, 2005: 367). During cremation, raking of the bones and dousing with cold liquids would reduce the bones to small fragments which would be collected and placed in a container before burial in a tomb (Noy, 2000: 186).

Noy (2000) discusses how various environmental factors would have affected the efficiency of the Roman cremation process and the degree of burning of the body. Within the Roman community, a half-burnt body was considered to be an insult to the dead and was seen as potentially dangerous because the deceased was not completely laid to rest (Noy, 2000: 193). Members of the community would carry out cremations in unfavorable circumstances in order to ensure complete burning of the body and prevent desecration of the body by enemies or animals (Noy, 2000: 188).

Fully accepted as a funerary practice in the Late Bronze Age of Sweden, cremation involved not only burning of the deceased, but the cremation of animals sacrificed for the individual or to the gods (Sigvallius, 2005: 413). Animals continued to be included in cremation rites through to the Viking Age in Scandinavia; these animals included sheep, goats, dogs, pigs, cattle, fish, horses, chickens, and cats (Sigvallius, 2005: 414). After burning, the remains were collected and often crushed, presumably for scattering on other areas than the burial mound (Sigvallius, 2005: 413).

During the 17th century, cremation in Europe was used as a method of disposing of the deceased for emergency situations, as with the Black Death and on battlefields to prevent the enemy from destroying the bodies of the soldiers (Davies, 2005a: xviii). In 1656, thousands of people died in Italy of the plague and were cremated in order to prevent the disease from spreading (Hughes, 2005: 106).

In the Southwestern United States, cremation was a frequently used method of disposing of the deceased by Native American tribes. J. Toulouse (1944) detailed his study on 16th century cremated remains found at Pueblo Pardo in central New Mexico. He does not mention the osteological data or cremation-related features exhibited by the burned remains, but focuses on the historical reports from Spanish settlers and their accounts of the funerary methods practiced by the local Native American tribes. He explains that the cremations found within central New Mexico must be considered intrusive, as the number of cremations is extremely insignificant in comparison to the number of inhumations for the proposed time period.

Toulouse's (1944) article includes numerous noteworthy excerpts from historical documents which can be used to further understand the varying cremation rites performed by Native Americans during the Spanish explorations of the southwestern United States; however the author makes no scientific observations of the few cremations uncovered. He does not discuss any analysis of the remains and instead considers the presence of a few cremations among inhumations as a potential problem when trying to understand the archaeological record. He discusses how the cremations must be ‘intrusive’, but does not define this term. It is assumed that he means the cremations were from a different culture and time period and had ‘intruded’ into the other archaeological context under study; however this cannot be verified.

C. Merbs’ (1967) article analyzed 100 Native American cremations from four sites in the American Southwest in order to examine the extent of biological information available. He reports that despite the extremely fragmented and poor condition of the remains, data on age, sex, and number of individuals was obtainable. He also discusses the degree of calcination of the bones and the condition of the body prior to burning based on coloration and fracture patterns exhibited by the remains. Merbs’ article not only describes important demographic information but discusses the importance of analyzing a cremation in order to obtain all anthropological information possible. Even if a limited amount of information is acquired, it can contribute to a better understanding of the archaeological record.

D. Creel (1987) analyzed an assemblage of cremated remains from the NAN Ranch Ruin site in the Mimbres region of New Mexico. This site was dated within the Three Circle Phase, at AD 750-1000. The author reports that a crematory pit was dug below a raised scaffold or platform on which the body was cremated. As the body and the wooden scaffolding burned, the remains fell down into the pit where they were eventually buried. The author reports differential burning of the cremated remains, specifically more intensive burning of the left pelvic bones than the right (Creel, 1989: 313). He explains that the body most likely fell to its right side as the scaffold collapsed into the fire, which would account for the less-intensively burned remains on the right side (Creel, 1989: 313).

J. McKinley (1994b) produced a large report summarizing the results from her study of over 2000 cremations from the Anglo-Saxon site of Spong Hill in Norfolk, England. This report includes demographic information in addition to details regarding animal remains found with the cremations, cremation-related features, and the completeness of the remains.

D. Ubelaker and J. L. Rife investigated cremated remains from a series of tombs in Kenreachi, Greece in 2007. The authors found small quantities of burned human bone within separate niches in the tombs that represented only a fraction of the total amount normally collected from a cremated skeleton (Ubelaker & Rife, 2007: 49). They theorized that the small percentage gathered for burial reflects the mortuary procedure utilized by the mourners and that the minute assemblages may have been sufficient to symbolize the individual at the burial site (Ubelaker & Rife, 2007: 51).

2.3 Modern Cremation Traditions

As in the past, the modern cremation process has become an important facet of the funerary practices throughout the world. In China, the popularity of cremation sea-burials has increased rapidly over the last ten years owing to the lack of cemetery space. With this method, mourners take the ashes of the deceased aboard a large ship which travels out to a designated spot. At this location, speeches are given and flower petals mixed with the burned remains are deposited into the sea (Jinlong, Yueling, & Jian, 2005: 57). This custom is considered an honor as it allows family members to pay tribute to their ancestors while protecting the environment by saving land (Jinlong, Yueling, & Jian, 2005: 57).

The Balinese tradition of burial begins with the initial washing of the body and subsequent burial of the remains. At a later time, the bones are disinterred and cremated. Cremation serves to convert a "polluted" soul into a purified ancestor who can be venerated in the family temple (Howe, 2005: 81). The funerary process can become extremely expensive for individual families as many cremation ceremonies are becoming more elaborate and seen as a reflection of the family's social and economic status (Howe, 2005: 82). In Borneo, deceased members of the Bidayuh tribe are rolled in a mat and placed in the corner of the house with their belongings before being cremated a day later (Lindell, 2005: 93). At the cremation grounds, the corpse is placed on a pile of firewood and burned with their possessions; it is believed that if the deceased's personal items are not burned with the body, then the soul of the dead would return to retrieve them (Lindell, 2005: 93).

Within the religion of Buddhism, cremation is the preferred funerary rite (Davies, 2005a: xix). It is normally only partial, as bones and teeth can have specific ritual, commemorative, and protective significance; the selected remains are then given to members of the community for making amulets (Crosby & Collett, 2005: 97). Cremation is closely linked with social status and the idea that as “death moves upwards” with the flames, so the individual’s consciousness exits the body to a ‘higher rebirth’ (Mills, 2005: 398-399).

In the Yanomami tribes of South America, the deceased’s burned remains are consumed in a custom of endocannibalism. After burning, the ashes are sifted and any unburned bones or teeth are extracted and pulverized (Davies, 2005b: 106). The remains are then mixed with plantain juice and drunk by the closest family members at the funeral ceremonies (Tahan, 2002: 13). In Japan, cremation ceremonies require active participation from family members and close friends. After the skeleton is reduced to small fragments, paired groups of relatives lift the remains with chopsticks and place them in a ceramic urn, which is then taken to a temple or family home (Kretschmer, 2005: 282).

Within the Hindu religion, cremation focuses on the philosophical and mystical dimensions of death and allows for the final offering of the deceased to the gods (Caixeiro, 2005a: 234; Sharma, 2005: 325). Individuals are anointed with ghee, perfumed, and adorned with garlands and pieces of gold through which the body may be worshipped by relatives prior to burning (Caixerio, 2005a: 234). After firing, the burned remains are taken to the River Ganges and placed into the water (Caixerio, 2005b: 236).

2.4 The Cremation Process: Modern vs. Archaeological

Common knowledge of the cremation process and its effects on bone has been based on studies performed at modern crematoria and on North American and European cremations. According to McKinley, “500° C is the minimum temperature necessary to get the body fats burning and maintain combustion until all water and organic components of the body are reduced, leaving the mineralized bone composed of enlarged hydroxyapatite crystals (1989: 65)." When an individual's remains are exposed to extreme heat and fire, there is the initial burning and scorching of flesh and hair. After 45 minutes (at approximately 600-800°C), most of the overlying soft tissues begin to deteriorate as water within the body evaporates, causing muscle contraction and exposure of the underlying skeletal structure. Above the critical temperature (700-800°C), the cremation is considered to be complete, with complete oxidation of the organic components and the bone mineral crystals having fused (Herrmann, 1977: 101-102; McKinley, 1994a: 339; Bohnert et al., 1998: 17; McKinley, 2000: 404; Thompson, 2004: S204; McKinley, 2008c: 165).

Although the cremation process in a modern crematorium takes approximately 1-2 hours, there are several factors that must be kept in mind which would alter the time of burning: time of day, temperature, and body composition of the individual to be cremated (McKinley, 1989: 65; Bohnert et al., 1998: 17). It is likely that cremations would take longer in the mornings if the furnace needed extra time to heat up. Certain levels of body fat are also needed to aid combustion and incineration of the body. Keeping this in mind, it is important to note that during the cremation process an emaciated individual would require more external heat and an obese individual would take longer, as there would be a larger amount of fat to burn (Evans, 1963: 83; McKinley, 1989: 66; McKinley, 1994b: 72-75; Mays, 1998: 219).

It should be noted that in an archaeological setting, cremations would have taken place in an uncontrolled environment where variables such as weather (wind producing inefficient or extreme oxygen levels, rain), nightfall, temperature fluctuations, ash/fuel build-up, and the need for a constant supply of fuel determined the degree and the length of burning of the cremation. Heavy rains would cause a cessation of the cremation process with lighter rains reducing the temperatures and strong winds would result in faster burning times, causing the cremation to burn unevenly and possible collapse of the pyre structure (McKinley, 2008c: 168, 178). As most of the heat generated by the pyre will have been lost to the atmosphere during burning, a constant external source of heat would have been needed to maintain increasing temperatures

(McKinley, 2008c: 165). Funerary pyres also do not retain and circulate hot gases and so the remains would have needed to be accessible throughout the entire process in order to be pushed back into the flames to ensure effective combustion (Gejvall, 1969: 469-470; McKinley, 2000: 404; Noy, 2000: 187).

Mays (1998) comments that if an archaeological cremation burial is poorly fired, it may be due to the fact that the duration of the pyre blaze was too brief, as opposed to the temperatures of the blaze being too low (Mays, 1998: 219). He also states that the bony parts of an individual covered with abundant fat will burn at higher temperatures than those surrounded by less fat (Mays, 2000: 220). While this may be true, it is also possible that areas of the body with very little fat, such as the bones of the elbow, hands, or feet, would burn at higher temperatures. It seems likely that these bones would be in contact with the fire for a longer period of time and would burn differently than other parts of the body, as there is no protective layer of fat over these bones which would shield them from the direct heat. Burning would also be affected depending on whether any clothing or materials such as blankets, leathers, furs, or pillows placed on and/or around the body as these would provide further insulation to the bones (McKinley, 2008c: 167). Unless bones are broken open, they will burn from the outside and it is likely that trabecular bone will take longer to oxidize than compact bone due to the greater infiltration of organic materials within its osseous structure (McKinley, 2008c: 165).

In both settings, after the cremation process was complete, remains were generally raked while still hot and brittle, either across the furnace chamber or the funerary pyre, causing further fragmentation. Although certain skeletal elements are still recognizable, the heat causes the spongy bone to shrink, the cortical bone to twist, split, fissure, and warp along trajectory lines, tooth enamel to shatter, and an overall reduction in bone length and width (Dzierzykray-Rogalski, 1966: 43; Lisowski, 1968: 79; McKinley, 1989: 66; Mayne Correia, 1997: 277; Grévin, Bailet, Quatrehomme, & Ollier, 1998: 130; Mays, 1998: 207; McKinley, 2000: 405; McKinley & Bond, 2001: 281; de Grunchy & Rogers, 2002: 1; Williams, 2004a: 281; Symes, Rainwater, Chapman, Gipson, & Piper, 2008: 24).

Studies have shown that cremated bone has greater mechanical strength and preserves better than unburned bone which is less resistant to weathering (Merbs, 1967: 498; Mays, 1998: 209; Liston, 2007: 60). Mays explains that as unburned bone is subject to decomposition, micro-organisms consume the organic material present within the bone and release acidic by-products which dissolve the inorganic bone mineral. Since cremated bone lacks any organic material, it tends to be more resistant to dissolution in the soil (Mays, 1998: 209, 216; McKinley, 2008c: 173). This may be true of completely calcined materials; however, the level of collagen left in insufficiently cremated remains varies across each fragment and cannot be accurately known. The degree of weathering to the remains will depend not only on the amount of collagen present within the bone structure after firing, but also factors such as soil acidity, length of time in the ground, and whether or not the bones were protected by an urn or other container.

2.5 Effects of the Cremation Process

Bone Structure Morphology

Several studies have documented the morphological changes to the bone structure at the microscopic level when exposed to heat. In Shipman et al.'s 1984 report regarding the experimental burning of bones and teeth from sheep and goats, it was discovered the bone tissues change with increasing temperature (Table 1).

Temperature	Resulting Morphological Change
0°C - 185°C	Bone tissues remain normal
185°C - 285°C	Surface becomes rough and uneven
285°C - 440°C	Surface grows glass and smooth
440°C - 800°C	Bone acquires a frothy appearance
800°C <	Bone tissues coalesce and melt into smooth nodules

Table 1. Bone Tissue Transformations due to Increasing Temperatures (Shipman et al., 1984: 315).

The authors reported that X-ray diffraction patterns analyzed on the same bone specimens revealed a distinct difference in crystal size of bones heated above 645°C and those under 525°C; those exposed to lower temperatures tended to broaden out and gradually increase in size as the temperatures increased (Shipman et al., 1984: 315-317). This would be a useful technique to use in order to determine the temperature range at which each fragment was burned; however, owing to a cremation specialist's ability to determine the approximate degree of heating by analyzing the coloration of the bones, it is doubtful that an osteologist would utilize X-ray diffraction methods to determine temperature of firing as it would be time consuming and costly.

In terms of the fragments selected, when analyzing for microscopic changes Shipman et al. failed to take into account the natural surface of the bones when analyzing for microscopic changes, which may have influenced the data. They also utilized goat and sheep bones that may have produced different information than human bones and teeth, which are rarely found complete in a human cremation. The procedure utilized is also a destructive one, thus preventing the use of the samples for future analysis. It would not be advisable to destroy large quantities of cremated bone from small assemblages unless a significant amount of information could be obtained.

Holden et al. (1995) performed an analysis on human bone in order to record the alterations to both the organic and inorganic components as temperatures increased. They discovered that as temperatures increased, there was progressive combustion of the organic material, up to 600°C when recrystallization of the bone mineral occurred. They theorize that the approximate age range of an individual can be determined based on microscopically analyzing the mineralized collagen fibers. Crystals from younger individuals will display increased fraying, larger spherical shapes, and random orientation as opposed to older individuals; they explain this is likely due to younger bone being thermodynamically more unstable than older bone samples (Holden, 1995: 41). The authors of this study used femoral shaft fragments of individuals ranging from 1 years of age to 97 years of age. Although they state that the samples are from both males and females, they fail to indicate the specific ages of the males and females and thus, how many of each sex were used in the experiment. In a forensically related situation, knowing the approximate age of the individual would be an important detail to obtain, hence the use of microscopic analysis. However, in an archaeological setting, it is unlikely that an osteologist would microscopically assess cremated bone fragments to obtain an age range. This is due mainly to the extra time and cost involved in such analysis; an approximation is likely to be made from the bone fragments present based on age-related features.

Grupe and Hummel (1991) performed an analysis on samples of domesticated pig bone in order to assess the trace element composition of cremated bone versus unburned bone for paleodietary studies. Using 20 cortical shaft fragments, the authors exposed the bones to a range of temperatures and discovered accelerated weight loss of the fragments occurring mainly between 200-300°C and 900-1000°C. After burning, they found the quantity of trace elements was limited and explained that further research must be done regarding the incorporation of trace elements from firewood or soft tissues into the crystalline bone structure (Grupe and Hummel, 1991: 180, 185-186). The authors also discuss how the results provide suitable information for paleodietary reconstruction of cremated individuals. However, they caution that due to volatilization and bone crystal modification, studies may become extremely restricted (1991: 185). In assessing their methodology, it is unclear as to how the use of pig bones as opposed to human bones would have provided different results. The bones are also burned in a muffle furnace which would also produce varying results than an archaeological pyre which would be subject to external environmental factors.

Bradtmiller and Buikstra (1984) used fragments of a human femur to test the degree of change of the osteons and microstructural components of cortical bone (1984: 535). After heating the fragments to 600°C in an electric oven and examining microradiographs taken from the bones, the authors found that the osteons in burned bone were larger than those in unburned bone. They proposed three explanations for their findings: 1) the bone fragments may have expanded slightly before shrinking and the bone stopped burning before shrinkage could take place; 2) the bone may have shrunk in its external dimensions, but due to the rearrangement of the microstructural elements, the osteons themselves increased in size; and 3) the bone fragment, osteons included, shrank as expected, but the shrinkage was not apparent due to a sampling error, due to various segments of the femur having different osteon sizes (Bradtmiller & Buikstra, 1984: 538-539).

While these findings provide insight into the degree of change in bone tissue after being exposed to heat, it is important to keep in mind the method used for heating. As in many previously mentioned studies, burning of bone fragments in an electric oven would produce different results, as the method of heating would be different from that in an archaeological setting. Temperatures could not be specifically controlled nor could the proper amount of oxygen be distributed along the entire length of the pyre at all times during firing.

McCutcheon (1992) used a set of artiodactyla bones in order to record the changes in the structure of hydroxyapatite crystals when exposed to various temperatures (McCutcheon, 1992: 353). Using X-ray diffraction techniques, the author found that there was an increase in crystalline size and a change in the volume fraction of the crystals as temperatures gradually increased (McCutcheon, 1992: 356). While it can be assumed that the results of this study would be the same had human bone samples been used, this may not necessarily be true. McCutcheon also utilizes a temperature controlled muffle furnace as his heating device, allowing samples to cool down for 4 hours within the furnace. This is unlike the conditions that would have occurred at a pyre site as temperature could not be firmly regulated and external environmental events such as rain or wind would have affected the cool down period.

Hiller et al. (2003) heated bone samples at varying temperatures in order to observe the changes to crystal size and shape during early stages of burning using small-angle-X-ray (SAXS) and wide-angle-X-ray scattering (WAXS) techniques (5092). They discovered that upon initial heat exposure, the bone fragments lost 30%-55% of their weight, which they attributed to dehydration, the loss of lipids, and the alteration of proteins present in the bone (2003: 5093). The authors' WAXS measurements recorded increasingly crystalline forms of hydroxyapatite with increased heat temperatures; similarly, the data derived from the SAXS measurements indicate an increase in thickness and alteration of the crystalline structure (Hiller et al., 2003:

5095). The authors begin by explaining the validity of their study as a potential aid for analyzing cremated human remains in archaeological and paleoanthropological research. However, their use of defleshed sheep bone rather than human bone should be noted; it is unclear how the results of their study would have differed had human bone samples been utilized instead of sheep bone. While they attempt to simulate ‘natural, inflesh’ burning by exposing the bones to heat only after 200°C, this procedure is probably quite unlike that applied to bones from archaeological contexts. Fragments were placed into a temperature-controlled furnace on ceramic plates, an obvious difference from ancient methods of cremation. The results of this study are only applicable to cremation studies where the bones had been defleshed immediately prior to burning, as the resulting data may have been different provided dry bones or in-flesh bones had been used.

Toward the end of their article, Hiller et al. (2003) explain that the information gathered from their study will allow researchers to better investigate heating techniques used in an archaeological setting. While small hydroxyapatite crystals may indicate shorter periods of burning at lower temperatures, it is highly unlikely that such research would be employed to assess the degree of thermal alteration of cremated remains. It would be much more reasonable to analyze the color of the remains as a reflection of temperature and time of burning as opposed to employing more advanced and expensive equipment.

Fracture Patterns

In 1943, W. M. Krogman published a series of observations regarding the types of heat-induced fractures in bone tissue. He noted that “wherever soft tissue surrounding a bone is scant or thin, the bone shows sharp, clear-cut heat fractures, charring, calcinations, and splintering; where the bone is deeply embedded in muscle....the action of heat on bone is to produce a molten condition, characteristic of fusion by heat (Krogman, 1943: 13). He concluded that the presence of “checking” is an indicative characteristic of dry bone cremation, with incompletely burned bone being from a fleshed cremation.

Krogman completed another study in 1945 on cremated remains from the Hopewellian and Adena cultures, where he was asked to determine whether bones were burned dry and defleshed or with flesh. W. M. Webb and C. E. Snow, in reporting on the work completed by Krogman, state that “it appears that when bones in a dry condition are incinerated, besides being calcined, they show cracking or ‘checking’; ...like the patina of age on an oil painting. However, if a body should be burned in the flesh, besides possibly showing an incomplete incineration of bone, it is often possible to see under power magnification the remains of completely consumed endosteum” (Webb & Snow, 1945: 189; Binford, 1963: 99).

Several years later, a similar study on cremated bone fractures was published by R. S. Baby on the cremated remains of 128 individuals from four Hopewell sites in Ohio to determine if dry bone cremations could be distinguished from those of flesh covered bone (Baby, 1954: 382). He disagreed with Krogman’s conclusion that “checking” was a characteristic indicative of only dry bone cremations. Baby’s study led to the conclusion that “checking” (defined as, deep transverse splitting) was a characteristic of flesh cremations while superficial checking, fine longitudinal striae, no warping, and deep longitudinal splintering or fracturing was indicative of dry bone cremations (Baby, 1954: 4; Binford, 1963: 100).

In the beginning of his article, Baby mentions how the presence of “normal” or non-incinerated bones within an assemblage of cremated remains indicates that the bones were burned with the flesh still attached. While it is possible that bones that have been slightly smoked were better protected from the fire by soft tissues and flesh, it will depend entirely on the length of time each bone is exposed to heat. Bones burned with the flesh on could eventually reach a state of calcination, provided they were left on the pyre for a lengthy period of time with adequate fuel sources. It may also be possible that bones that had been defleshed prior to burning would be barely incinerated; these fragments may have been located on the periphery of the pyre or removed from the heat shortly after the burning began.

In regards to the actual experiment carried out by Baby, some important details are omitted from the publication. The temperatures at which the bones were fired are not included and the duration of exposure to heat is not discussed. Although Baby explains that a fleshed cadaver and green bones were used in his experiment, he does not state which bones were selected in each category or the resulting fractures on each specific skeletal element. He also includes results for dry bones, which he fails to describe in his study sample.

In discussing the cremated remains from Hopewell sites in Ohio, Baby theorizes that complete destruction of the skeleton would indicate cutting of the muscles at joints, causing contraction and subsequent exposure of the bones once fired. However, there are several possible explanations for this theory. A human skeleton may be completely calcined if exposed to high temperatures for an extended period of time; muscles need not be cut in order for the skeleton to become thoroughly cremated. Bones that have been cut along muscle attachments may not be completely burned, as they may have been placed into the fire for only the time needed to remove the flesh. It must also be noted, that no where in his study does Baby discuss cut marks on the bones, which would be likely if the body had been dismembered. Regarding dismemberment, Baby further observes that the crematory basins found with the remains would have been just large enough for a torso and several dismembered limbs. While this may be true, small crematory basins does not necessarily indicate immediate dismemberment and burning of the body after death.

In an attempt to verify Baby's conclusions, another experiment was performed by L. S. Binford at the University of Chicago. Using both dry and fresh bone, Binford confirmed Baby's findings. Dry cremated bones exhibited superficial checking, straight longitudinal splitting, and no warping while fresh bones exhibited warping, ragged longitudinal cracking, and deep serrated transverse fracturing along curvilinear planes (Binford, 1963: 101, 108; Ubelaker, 1978: 35).

Although producing similar results to Baby's study, there are limitations to Binford's research that should be addressed. In his initial analysis of dry bones, Binford placed various human and monkey bones in charcoal fires and then doused half the bones with water. While throwing water on the fire created increased fracturing as a result of rapid cooling, he does not specify which bones were left to cool naturally and which exhibited further fragmentation due to water dousing. He also does not specify how long the bones were allowed to burn within the fire or to what temperature the samples were exposed.

Similar problems of ambiguity arise when his study is directed to in-flesh and green bone samples. Binford fails to explain which bones were defleshed prior to the experiment. It is also important to keep in mind the potential differences may that resulted had a formalin preservative not been used on the sample fragments.

An additional study on surficial fracture patterns was performed in 1980 by M. D. Thurman and L. James Willmore to see if there were differences between fleshed and freshly defleshed cremated bones. Using four in-flesh and four recently defleshed adult humerii, the authors found that green/defleshed bone had serrated fractures at the epiphyseal ends only, straight, parallel-sided fractures along checking lines, and less pronounced warping. This differed from fleshed cremations which exhibited warping, diagonal fracturing, and serrated, transverse cracking (Thurman & Willmore, 1980: 281; Mayne Correia, 1997: 279).

The authors commented that although the in-flesh bones did not exhibit deep checking, they may have been further exposed to the fire. They concluded by saying that in-flesh, defleshed, and dry cremated bone can all be differentiated from one another based on the resulting fracture patterns and theorize that length of burning, air temperature, the kind of wood used in the fire, the proximity to the center of the fire, and the manner of cooling may play important roles in the differentiation of fracture patterns on cremated remains (Thurman & Wilmore, 1980: 282).

In order to test the results obtained by the previously mentioned authors, J. E. Buikstra and M. Swegle studied the fracture patterns on 24 calcined femora, 8 dry, 8 'green' or defleshed, and 8 fleshed. They concluded that both green and fleshed remains exhibit deep longitudinal and transverse cracking with cortical exfoliation while dry bones displayed shallow checking and little to no warping. They agreed with previous researchers in that it is easier to distinguish between dry and defleshed/in-flesh cremations than it is between the latter two (Buikstra & Swegle, 1989: 255).

In the beginning of this article, the authors discuss the importance of knowing the "condition" of the body at the time of cremation, as this will facilitate in the understanding of specific mortuary information such as distance between mortal event and the burial site, season of death, and extent of the burial rituals (Buisktra & Swegle, 1989: 247). While this statement is no doubt true, it may be difficult to obtain such information from the cremated remains, especially if there is only a small quantity available for study.

The human bone samples chosen for cremation were placed into either a gas incinerator or beneath a wood fire. Although Buikstra and Swegle attempt to recreate archaeological conditions with such heating devices, it is possible that different results would have been obtained had the samples been burned on a re-created pyre. This decision may have been influenced by the authors' desire to focus on acquiring data that would be applicable to studies of resource procurement and prehistoric culinary activity but not necessarily studies focusing solely on cremation as a method of mortuary practice. The human remains had also been soaked in either acetone or embalming fluid; it is unknown how these chemical fluids would have affected the final outcome of the study.

To summarize, Table 2 displays the fracture patterns resulting from the previous five studies. Overall, dry cremated bones tend to exhibit superficial cracking or "checking," longitudinal fracturing, and no warping or twisting. Both green or freshly defleshed bone and in-flesh bone exhibit deep longitudinal or U-shaped fissures, with curved fracturing rare, but more common in fleshed remains. Transverse cracks are more common in fleshed remains but are deep when present in both green and fleshed bones. Cortical exfoliation occurs more frequently in green bones than fleshed remains and warping tends to be frequent in both defleshed and fleshed cremated bone.

Shrinkage

Similar to fracture patterns, shrinkage is another characteristic of cremated bone which has been heavily analyzed, with varying results. As previously discussed, when remains are exposed to extreme temperature and heat, there is a reduction in the length and width of the bones due to dehydration**.** The amount of shrinkage in a bone fragment depends on: 1) the density/mineral content of the bone, 2) the aspects of the mineral content of the bone tissue, 3) the distribution of bone types (compact, spongy, and lamellar), and 4) the temperature and duration of exposure (Herrmann, 1977: 102).

According to Ubelaker (1978), shrinkage does not occur until 700°C. Once this temperature is reached, there is a gradual progression until 900°C; at any temperature above this point, no further shrinkage occurs (Ubelaker, 1978: 34). Despite shrinking slightly and fissuring concentrically, spongy bone tissue tends to retain its overall shape and size during the process of incineration and exhibits less definite changes due to heat than cortical bone owing to the lack of identifiable architectural features and characteristics (Forbes, 1941: 59; Lisowski, 1968: 79; McKinley, 1994a: 339).

Using a collection of 60 mandibles and astragali from sheep and goats, Shipman et al. (1984) tested for shrinkage rates by taking initial measurements, heating the bones, and then taking subsequent measurements to record the degree of structural contraction. The shrinkage percentage was a function of the temperatures to which the specimens were heated and was calculated by the following equation: [(original dimension – altered dimension) / original dimension] x 100 (Shipman et al., 1984: 310, 321). The authors found that the variance in shrinkage percentage is correlated directly to the degree of heating and that shrinkage rates remained less than 5% below temperatures of 700-800°C (Shipman et al., 1984: 320, 322). Once temperatures exceeded 800°C, distortion levels increased rapidly with the maximum mean percentage for the bone samples being approximately 15% (Shipman et al., 1984: 322).

Bradtmiller and Buikstra (1984) burned several 10 cm sections of both dry and green femur bone to approximately 600°C and found an overall shrinkage rate of 5%, with notable deformation reported in the bone burned green. The primary motivation behind their study was to discover how bone microstructure changes after exposure to high degrees of firing. The results would in turn, affect whether the technique of determining age of an individual microscopically could be performed with cremated remains from cases of forensic and archaeological interest.

Bone Type	Krogman (1943)	Baby (1954)	Binford (1963)	Thurman & Willmore (1980)	Buikstra &Swegle (1989)
Dry Bone	Calcined; checking	Superficial checking; fine longitudinal striae; deep longitudinal fracturing or splintering; no warping	Superficial checking; deep longitudinal fracturing; no warping; no curved cracks	Information not collected	Shallow checking, longitudinal shaft fissures, and transverse cracking
Green or defleshed Bone	Difficult to distinguish from in-flesh cremations	Similar to bones in Category 1& 2, and possibly 3 of in-flesh cremations	Generally the same as in-flesh cremations; checking in most cases extends throughout the entire bone	Serrated fractures at epiphyseal ends; straight, parallel fractures along checking lines; less pronounced warping	Cortical exfoliation, deep longitudinal fissures, deep transverse splitting, curved cracks very rare
In-flesh Cremation	Possible incomplete incineration; remains of incompletely consumed endosteum	Three categories, determined by proximity of bones to core of fire and length of burning: Category 1: Complete incineration. Color light grey to blue grey to buff; deep checking; diagonal transverse fracturing; warping Category 2: Incomplete incineration (smoked). Blackened from incomplete combustion of organic material in bone; frequent bits of charred periosteum adhering to external surfaces Category 3: Non-incineration (normal). Not affected by heat, but some smoking on broken edges.	Both angular and curved checking; deep longitudinal and transverse fractures, with major warping on fracture edges; transverse fractures tend to be curved and serrated in appearance; sometimes endosteum identifiable on partially calcined bones	Diagonal fracturing; warping; serrated, transverse cracking	Deep transverse cracks common, curved fractures, cortical exfoliation

Table 2. Fracture Patterns from Five Selected Cremation Studies

In addition to using fragments from a cadaver, the authors burned portions of a human femur recovered from an archaeological site. As there was apparently no associated provenience, information regarding the nature of the bone, how long it had been buried in the ground or exposed, or what condition it was in, was not included. The authors maintain that owing to the fact that the femur had become demineralized, the thin sections needed for analysis could not be read, and therefore, microscopic ageing methods could not be used.

Although it is unlikely that an osteologist would employ microscopic methods of ageing for cremated remains owing to the extensive time and effort required and the destructive nature of the technique, it is clear that additional samples from archaeological sites are needed adequately test the idea that such techniques cannot be used. It is possible that the results would have been different had a sample been obtained that was not demineralized, therefore allowing the thin samples to be readable. It is important to note, however, that the methodology selected by the authors included heating in a small oven which would have been unlike that in an archaeological setting. The study also fails to note the exact temperature which the bone samples reached; rather the oven was left on until the bone temperature was "likely" to be 600°C.

Another possible cause of shrinkage may be associated with the structural alterations within the hydroxyapatite (Mays, 1998: 207). These changes can be studied using X-ray diffraction techniques. In the 1984 study by Shipman et al. using x-ray diffraction, crystallinity changes were also recorded and the authors found that up to 525°C, there was a gradual increase in crystal size. The crystals continued growing in size with a higher overall crystalline structure until 645°C, after which there was no further change (Shipman et al., 1984: 207).

Holland (1989) used bone fragments from a collection of eight cadavers in order to determine the amount of shrinkage that occurs in the cranial base as a result of exposure to low temperature burning (less than 800°C) (Holland, 1989: 459). After selecting a small fragment of cranial bone with the occipital condyles and the foramen magnum, the fragment was then cremated. He found that the amount of shrinkage present after burning ranged from 1.00% to 2.25%, and concluded that little or no shrinkage occurs to bones fired at temperatures less than 800°C (Holland, 1989: 460).

This study indicates that in situations where bone fragments have been burned at low temperatures, that researchers can assume an extremely low, if non-existent shrinkage rate. This inference is notable to keep in mind when working with cremated human remains; however the methodology which was utilized for Holland's study is structured more for a modern forensic case rather than an archaeological cremation. Bone fragments were placed into separate kilns with constant temperatures set at 400°C and 500°C, respectively while the other fragments were soaked in a flammable liquid and ignited. At this point, the author fails to mention the maximum temperature reached by the samples that were ignited after being immersed in fluid. While the reader is lead to believe that the samples never reached above 800°C, it cannot be assumed that these temperatures were never reached. In an archaeological cremation, temperatures would rarely be constant as the pyre would have been hotter in certain areas than others. The author also uses below 800°C as the maximum for 'low temperature burning' (Holland, 1989: 409). Considering 800°C to be low temperature burning applies only to modern forensic cases, as temperatures above 645°C are considered 'high' degrees of firing.

It is also unlikely in an archaeological setting that the body would be completely soaked in flammable liquids prior to burning. Even in the instances that liquids were applied, they would have been most likely applied to the clothing and flesh of the individual, rather than the bones as they would have had to be defleshed or dry prior to burning.

While this study does present informative data regarding the effects of firing on human remains, it needs to be emphasized that it is limited to forensic research as opposed to archaeological research. Not only is the methodology utilized unlike that which would be encountered in an archaeological setting, but it does not take into consideration other areas of the body that would be likely to survive burning.

McCutcheon describes in his article on heat-treated bones that an understanding of the osteological dimensions of a population which practiced cremation can only be obtained if the amount of shrinkage due to heat exposure is observed (McCutcheon, 1992). This is clearly not the case, as in all studies of cremated remains from archaeological sites the exact rate of shrinkage will not be known owing to the inability of the osteologist to obtain the original measurements of the bones prior to burning. In many situations, it is also important to consider that the surviving bone fragments may not exhibit any skeletal features from which measurements would normally be taken; therefore, the skeletal dimensions would be inaccessible regardless of the rate of shrinkage.

In the previously mentioned 1989 article by Buikstra and Swegle, the authors also analyzed shrinkage rates of the 24 femora samples. They found that under constant temperatures of 700°C-800°C, there was less than 6% shrinkage of the bone fragments (Buikstra & Swegle, 1989: 256). Grupe & Hummel (1991: 178) report 30% shrinkage of the hydroxyapatite owing to recrystallization and crystal fusion. Herrmann's (1977) publication on burned remains notes a shrinkage rate of 1%-2% for incompletely cremated bones, fired at temperatures below 700-800°C (Herrmann, 1977: 101-102).

In summary, the studies mentioned above regarding shrinkage rates show that there is no consistent overall shrinkage rate which can be applied to archaeological situations, as this depends on the age and specific skeletal element of each individual. McKinley (2000) explains that since shrinkage is related to transformation of the crystalline bone structure and the specific temperature at which the body was fired, there will inevitably be variability in the degree of shrinkage per individual, as different bones may be subject to different temperatures (McKinley, 2000: 406; McKinley & Bond, 2001: 282). There also seems to be a correlation with shrinkage rates and increasing temperatures, as greater degrees of shrinkage tend to occur above 600°C (McKinley, 2000: 406).

Temperature of Firing

The "color of a bone is a function of the amount of organic phase left in the bone and the chemical and physical state of the remaining organic matter" (McCutcheon, 1992: 365). One of the first researchers to investigate the temperature of firing for a cremation series was British anthropologist, Calvin Wells. Wells studied a collection of early Saxon cremation burials, many of which contained glass beads that showed evidence of firing and had been partly fused (Wells, 1960: 35). After re-heating some of the beads, he found that they began to soften and melt at approximately 850°C and were molten at 940°C (Wells, 1960: 36, cited in Mays, 1998, 216). From that temperature range, Wells determined that the Saxon cremations had been burned at approximately 900°C (Wells, 1960: 36).

Other researchers have attempted to estimate the temperatures reached by ancient cremation pyres by analyzing the variety of color changes that occur with increasing temperatures. Color is an important attribute of the degree of thermal alteration because the change in bone color is drastic and can be easily observed (McCutcheon, 1992: 348). It reflects the ongoing chemical processes associated with the various stages of cremation (Mayne Correia, 1997: 276; Devlin & Herrmann, 2008: 110). By analyzing bone color and obtaining the approximate maximum temperature at which the cremation burned, researchers are able to infer the mode of heating employed, as maximum temperatures reached by fires and other heating devices are known (Shipman et al., 1984: 308).

In the previously mentioned study by Shipman et al. (1984), the modifications in color with varying temperatures were also assessed. The changes in color were recorded using the *Munsell Soil Color Charts*, a system which notes the colors by hue, value, and chroma, and provides a standardized reproducible system for describing colors (Shipman et al., 1984: 309). The results from their study are summarized in Table 3.

Stage of Burning	Resulting Color
I : (20 – <285°C)	White, pale yellow, yellow
II : (285 – <525°C)	Reddish brown, dark grey, dark brown, reddish-yellow
III : (525 – <645°C)	Black, blue, reddish-yellow
IV : (645 – <940°C)	Predominantly white, light grey, light blue
V : (940 + °C)	Neutral, white, medium grey, reddish-yellow

Table 3. Coloration changes with increasing temperatures (Shipman et al., 1984: 313).

The authors theorized that the decomposition of the organic component occurs between 360°C and 525°C, when the variability in hue, chroma, and value increases in regards to color changes of the bone fragments (Shipman et al., 1984: 321). It is important to keep in mind that the variation in color of each bone fragment could have resulted from trace elements present in the soil which may have leached into the fragments during burial.

McCutcheon analyzed heat-related changes on artiodactyla bones and found that the bone color varied with each incremental increase in temperature up until 600°C, when the only color observed was neutral white (1992: 354). He reported that unheated bone begins at pale yellow to white and turns pale brown to reddish yellow as temperatures increased to 130°C to 240°C. From 240°C to 340°C, colors of dark reddish-brown, to black, to very pale brown were reached and at 440-600°C, a light-brownish grey was exhibited (McCutcheon, 1992: 354).

As with similar studies that utilized animal bones, it is important to keep in mind the potential differences that may have occurred had human bone fragments been used. McCutcheon also discusses how coloration patterns of the bones may allow researchers to infer the position of the body during burning. This cannot be directly inferred, as bone fragments from the same skeletal element may display different colors due to bones being pushed around on the pyre during burning. In order to reconstruct the position of the body on the pyre, a significant amount of bone fragments from the same skeletal elements would need to be present; these elements would need to be rebuilt so that a clear idea of the burning across each bone was evident.

Stiner et al. (1995) collected and burned an assemblage of modern goat and cow bones from Israel in order to examine the macroscopic appearance and color produced after bones were subject to fire. The initiative behind this research was to determine the extent burning damage has on archaeological materials and what it reveals about prehistoric human behavior.

While information obtained by Stiner et al. may be relevant to research concerning burned bones, their study is not necessarily applicable to *cremated* human remains as cremated remains are not taken into consideration. Burned bones were considered by the authors to be from the context of cooking fires or shallowly buried bones that had been burned due to a campfire being built above them. Sample fragments were burned at temperatures of 900-1000°C in several experimental fires and were either shaken in cardboard boxes or trampled on to simulate increased fragmentation by external pressures.

At this point, it should be noted that the length of time of burning for the bone fragments was never mentioned in the publication; the authors only report that the peak temperatures of each fire were reached within five to ten minutes of setting (Stiner et al., 1995: 227). Bones were removed after each fire cooled, however the duration of firing was never assessed and, presumably, would have varied considerably.

While applicable to studying burned bones from archaeological sites, relying on data from this study may be misleading as burned remains from funerary texts are not included or considered. It is likely that the information gathered from this research would not be germane with the resulting conditions of cremated bones, especially when considering the methods of burning employed. It would be imprudent to attempt to correlate the degree of fracturing of burned bones that have been subjected to mild pressure, i.e. trampled upon, with the fracturing patterns present after burning and raking on a cremation pyre.

In 1998, Mays completed a similar experiment, using the published methods and temperature increments of Shipman et al. (1984). Mays discovered that although his results did not exactly match those of Shipman et al., a similar basic pattern of dark reds and browns was exhibited on bones at low firing temperatures, leading to bones being charred black in appearance, and then becoming progressively lighter in color as temperatures increased so that the ultimate color at the maximum temperature (645-1200°C) was white (Mays, 1998: 217).

Walker et al. (2008) burned samples of a femur diaphysis at various temperature intervals during one-, two-, and three-hour periods in order to determine the effects that different cremation conditions had on bone color. As the bone samples were heated to 200°C, there was a gradual darkening in color from pale tan to dark brown and at 300°C, all specimens turned from dark brown to a charred black, as the organic material became carbonized (Walker, Miller, & Richman, 2008: 132). As temperatures gradually increased above 300°C, the bones began to change until the samples were lighter in color.

From the multiple studies conducted, it is generally accepted that there is a gradual change in color from the beige/tan of unburned bone at approximately 200-300°C to a darker brown to charred black as temperatures exceeds 300°C. Increased exposure to temperatures above 700-800°C result in calcined or fully oxidized bone ranging in color from bluish-grey to buff to white; white indicating longer exposure to hotter temperatures than blue-grey and a complete combustion of the organic component (Lisowski, 1968: 78; Ubelaker, 1978: 34; Eckert, James, & Katchis, 1988: 190; McKinley, 1997a: 55; Bennett, 1999: 2; Whyte, 2001: 438; Crubézny, Ricaut, Martin, Erdenebaatar, Coqueugnot, Maureille, & Giscard, 2006: 901; Fairgrieve, 2008: 48-49; Schultz, Warren, & Krigbaum, 2008: 79).

Researchers must also be aware that the bones of one individual may exhibit a variety of colors due to being in the center of the fire or on the periphery, the amount of fat on the body, the fact that cortical bone takes longer to oxidize due to a higher infiltration of organic material, the size and shape of the bone, the position in the fire (the individual lying on their back or side), and the position of limbs (across the chest, alongside the body, etc) (Creel, 1989: 313; McCutcheon, 1992: 353; Nicholson, 1993: 423; McKinley, 2000: 405; McKinley & Bond, 2001: 282; Williams, 2004a: 281).

Occasionally, additional colors of black, dark brown, red, pink, yellow, or green are visible on some of the bone fragments. Williams (2004a: 281) states that black discoloration may be attributed to charred muscle or ligament tissue. According to Lisowski, dark-brown discoloration, especially on long bone fragments, may also be due to hemoglobin in the bone or iron-levels in the soil rather than lower levels of burning (Lisowski, 1968: 78). Yellow staining is thought to have been attributed to the presence of high levels of zinc in the soil and pink staining is rarely found, being present mainly when small fragments of modern copper are included with the individual (Dunlop, 1978: 163-164, 172-173). Greenish-blue shades are generally attributed to the presence of copper in the soil or copper or bronze artifacts having been placed either on or with the body (Lisowski, 1968: 78; Gejvall, 1969: 471; Dunlop, 1978: 164; McKinley & Roberts, 1999: 10).

It would be desirable to evaluate the soil found with the cremated remains for high levels of copper or other minerals which may have contributed to any extrinsic coloration. However, this is highly unlikely to occur, as soil samples are often not collected or would be not analyzed in relation to the osteological findings.

Fragment Survival

While it is nearly impossible to identify every bone fragment, approximately 20-50% of the surviving material in a typical cremation is identifiable, the majority being fragments of long bones or articular surfaces (Spence, 1967: 71; Lisowski, 1968: 79; McKinley, 1989: 68; McKinley, 2000: 408). Aside from long bones, there are principal skeletal elements that commonly occur and are easily recognizable despite being possibly distorted or warped. Based on Spence's study, cranial fragments become curved with the inner and outer tables of the diploë occasionally becoming separated (1967: 71). Portions of the occipital, parietal, and frontal regions are normally found, with the major segment of the temporal recovered being the petrous bone (Merbs, 1967: 501; Lisowski, 1968: 79; Holland, 1989: 458; McKinley, 1989: 69; McKinley, 1997: 131; Mays, 1998: 212, 214; McKinley, 2000: 412). Sections of the alveolar bone are normally found with empty tooth sockets and from the mandible, the most commonly found portion is the condyloid process.

McKinley (1989) reports that in an average dry skeleton and approximately the same weight as a cremation, the percentages of each skeletal element would be: skull (18.2%); vertebral and pelvis (23.1%); upper limbs (20.6%); and lower limbs (38.1%) (1989: 68). She cautions that despite keeping these percentages in mind, it is important to remember that certain areas of the body survive the cremation process better than others and thus would be more likely to be collected, rather than the collection be deliberate (McKinley, 1989: 68). While certain areas of the body tend to survive better than others, it can be argued that the length of burning and varying temperature levels play an imperative role in which bones will remain after burning. If remains are exposed to low temperatures for short periods of time, it seems likely that a large percentage of the skeleton will remain relatively intact, as the cremations are considered inefficiently fired if they are not completely calcined.

Both Mays (1998) and McKinley (1989) report that with cremated remains, the larger the fragment size, the larger proportion of material that can be identified and the more information that can be obtained regarding pyre technology and ritual (McKinley, 1989: 68, 72; Mays, 1998: 209). Though to some extent this is true, it is possible that large fragments could be as uninformative as smaller fragments. Bone fragments with definite, distinguishable features will be easier to identify than cancellous bone fragments regardless of the size. Unless specific diagnostic features are present from which to assess age or sex, an osteologist may only be able to report on cremation-related aspects such as fracture patterns and degree of firing.

Williams (2004a) observed that based on forensic and ethnographic studies, cranial fragments are the most diagnostic element recovered when sifting through pyre debris (Williams, 2004a: 282). Of the dentition, unerupted teeth and the roots of erupted teeth are usually recovered intact or can be reconstructed; the enamel is rarely found as it tends to shatter with intense heat exposure (Wells, 1960: 33; Merbs, 1967: 501; Lisowski, 1968: 78; Gejvall, 1969: 471; Johanson & Saldeen, 1969: 16; McKinley, 1989: 69; Mayne Correia, 1997: 278; McKinley & Bond, 2001: 285).

Postcranial fragments generally found are illustrated in Figure 3. Of the vertebral column and ribs, the most frequently recovered fragment is the odontoid process or dens of the axis (2nd cervical vertebrae) (Mays, 1998: 214). Other vertebral fragments that typically survive the cremation process are the transverse processes, segments of the vertebral bodies or centrums, neural arches, articular facets, and the foramina of the anterior sacral wing (Spence, 1967: 79). Articular ends of ribs may be commonly found with the head and tubercle, but most commonly shaft fragments are recovered. Of the scapula, the two most frequently recovered fragments are the glenoid cavity and the vertebral border along the superior edge. Clavicle fragments are not commonly recovered, although when they are, it is mainly portions of the lateral end

(Spence, 1967: 79). Of the pelvis, sections of the pubic symphysis tend to survive along with portions of the iliac crest, the acetabulum, and the greater sciatic notch.

Long bones are frequently represented by fragments of the proximal and distal epiphyses. As discussed by Spence (1967), humeral heads are distinguished from femoral heads by their flattened appearance, the presence or absence of the fovea capitis and any surviving portions of the greater and/or lesser trochanters. Distal ends of the humerus can be distinguished by the capitulum, the trochlea, and the olecranon fossa on the posterior side. Of femur, tibia, and fibula fragments, the segments of the proximal and distal ends such as the distal condyles of the femur, the medial and lateral condyles of the proximal end of the tibia, and the head and medial malleolus of the fibula are the most frequently recovered. Identifiable radial fragments that are usually recovered include the head and the triangular shape of the distal end and the styloid process (Spence, 1967: 79). Ulnar fragments include the sharp interosseous border of the shaft, the trochlear notch, the styloid process, and the coronoid process.

Of the hands and feet, the carpals and phalanges are the bones that are most likely to survive, particularly the proximal and distal ends (Spence, 1967: 80; Lisowski, 1968: 79; McKinley, 2000: 405; McKinley & Bond, 2001: 282). The proximal and distal ends of the metacarpals and metatarsals are also quite frequently recovered. It is often difficult to accurately identify specific carpal bones, but the larger ones (scaphoid, lunate, hamate) often preserve enough to make an identification. Tarsal fragments are often recovered, most frequently the lateral portion of the calcaneus and the talus (Merbs, 1967: 501). Cuneiforms are rarely found, but when they are, they are generally recognizable by shape (Spence, 1967: 80).

2.6 Concluding Remarks

The previously discussed topics have outlined the detailed information that can be obtained from studying cremated remains. It is clear that such studies have greatly increased the amount of knowledge available for archaeologists regarding burned bone; this data will allow for future research into the burial customs and mortuary practices of societies where cremation is the primary form of burial. The recognition and incorporation of such research into the overall understanding the archaeological record will aid researchers in compiling a more comprehensive interpretation of past cultures throughout Europe.

CHAPTER III

STUDY AREA

3.1 Geography

Slovenia is situated within the Southeast Alpine geographic region at the head of the Adriatic Sea, with northern Italy on the western border, the eastern Alps and Austria to the north, the middle and lower Danube valley, Hungary, and the Pannonian plains on the east, and the Balkan peninsula to the south (Hencken, 1978: 3; Mason, 1988: 211; Mason, 1996: 1). Aside from the current borders of Slovenia, there are two additional regions encompassed by the Southeast Alpine region: Carinthia and Styria. Carinthia is located in south-eastern Austria. It is dominated by alpine land and the river Drau which flows from the Lienz basin, through Carinthia, and into the Klagenfurt basin (Mason, 1996: 1).

The region of Styria lies to the east of Carinthia and north of Slovenia. The creation of Styria as a historical region began during the middle of the 11th century, where it extended through southern Austria and northeastern Slovenia (Teržan, 1990: 11). This region existed as a political division of the Austro-Hungarian Empire with three separate areas (Upper and Middle Styria within Austria, Lower Styria within Slovenia) until 1918, when Yugoslavia was granted the region of Lower Styria (Mason, 1996: 10). After Slovenia gained its independence from Yugoslavia in 1991, Lower Styria or Štajerska became a part of Slovenia. It is bordered on the south by the Sava Heights, the Kamnik Mountains, the Savinjske Alpe, and the Karavanke on the west, the lower route of the Mura River on the southeast, and the Drava River Region and Kozjak Range on the north (Teržan, 1990: 12). In 1957, Slovenian geographer Anton Melik specified various geographic regions in eastern Slovenia to be included in the Styrian region. These regions include the Slovenian Drava Basin (comprised of the Pohorje Drava Basin, the Lower Drava Basin, and the Mura Basin), the Savinja River Region, the Sava Heights, and the Upper Sotla River Region (Teržan, 1990: 11).

The Pannonian region of eastern Slovenia is mainly comprised of beech, oak, and chestnut forests with lowland sand and clay hills and intensively cultivated areas

(Perko, 2004: 16). In the north, the country is dominated by high mountain ranges including the Carnic Alps, Karavanke Alps, Savinjske Alps, and the Julian Alps which are oriented in an east-west direction (Mason, 1996: 2). These Alpine ranges are covered with high mountain vegetation and thick beech, fir, and spruce forests with winding rivers and their connecting tributaries (Perko, 2004: 14).

Within the central and southeastern part of Slovenia runs the river Sava which courses through the Ljubljana basin and the Dolenjska region, lying between Ljubljana and Zagreb, Croatia. This area is primarily Alpine hills and plains. Within the Alpine hills, there is a prevalence of beech forests with few agricultural plots and mining zones. The Alpine plains within central Slovenia were formed by riverine processes depositing sand and gravels onto basin floors (Perko, 2004: 15). Winters in the eastern section of Slovenia in Lower Styria or Štajerska region reflect a continental climate with temperatures ranging between -3°C and 0°C during the winters and 15°C to 20°C during the summer (Mason, 1996: 3; Andrič & Willis, 2003: 809; Dular & Tecco Hvala, 2007: 63).

During the First Millennium B.C., the climate was divided into two phases: the Sub-Boreal and the Sub-Atlantic. The Sub-Boreal phase began in approximately 2500 B.C. and continued to 600 B.C., with a warmer and dryer continental climate (Brooks, 1927: 412; Härke, 1979: 17; Beug, 1982: 91; Mason, 1996: 3; Kristiansen, 1998: 110). As discussed by M. Ralska-Jasiewiczowa and W. Koperowa, broad beech woodland zones with alder, hornbeam, lime, and hazel dominated much of the landscape until climatic changes and forest clearance caused a lowering of the tree-line at the end of the Sub-Boreal (as cited by Coles & Harding, 1979: 337; Gardner, 1997: 72; Gardner, 1999: 166). Pine and spruce were replaced by juniper trees and as the Sub-Boreal gave way to the Sub-Atlantic climate phase, oak replaced low level forests and pastures, followed by beech and alder (Beug, 1982: 97; Mason, 1996: 3). According to Mason, as the Sub-Atlantic progressed, the Karst area became covered with mixed oak forests, including stone oak, ash, and black hornbeam, the Ljubljana Basin was covered with reeds and marsh vegetation, and fir and larch stands gradually took the place of beech and pine forests at the higher elevations (1996: 3). The wet and cool period of the Sub-Atlantic lasted up until approximately 300 B.C. (Brooks, 1927: 412; Härke, 1979: 17).

3.2 A Brief History of the Late Prehistoric Archaeology of Eastern Slovenia

Interest in the archaeology of Slovenia began during the 17th and 18th centuries when the region was a part of the Austro-Hungarian Empire. During the 19th century, new school reforms began to introduce regional history and the search and understanding of antiquities into secondary schools. Tumuli discovered were subsequently excavated by landowners and regional museum societies were founded to encourage and confirm the flow of archaeological material into historical institutions (Teržan, 1990: 14; Mason, 1996: 9). The first excavations in the 19th century were at Graz in 1811, Ljubljana in 1821, and Klagenfurt in 1843 (Mason, 1996: 9). Sites excavated were mainly burial sites or flat cemeteries which have created a bias towards studies involving mortuary data (Mason, 1996: 10; Dular & Tecco Hvala, 2007: 15). Excavations were also completed by different excavators and institutions, which caused discrepancies in excavation methods, the technique in which data was recorded, and the system of distribution to regional societies and collectors and to national museums (Mason, 1996: 10).

In 1875, Ruše I was first discovered and excavated by A. Müllner and G. Wurmbrand; it was this excavation which was later used by Müller-Karpe as the basis for the chronological division of the Halstatt B period in Styria (Müller-Karpe, 1959: 115, 118; Mason, 1996: 42; M. Črešnar, 2006: 98, 100). From 1899-1903, large scale excavation efforts were carried out at the hillfort and cemetery near Habakuk near Lepa Ravna at Poštela. Additional sites were excavated including Vače, Klein-Klein, the Urnfield Cemetery at Hajdina, the cremation graves at Rifnik, and the Pivola cemetery (Teržan, 1990: 14-15).

After 1917, when Štajerska or Lower Styria became a province of Yugoslavia, the Maribor Historical Society became the leading organization in scientific work with its journal (ČZN) and its aim to institutionalize all Lower Styrian museum facilities

(Teržan, 1990: 16). Despite progress in establishing the cultural affirmation of Štajerska, problems remained with excavation techniques as there were no professional archaeologists or systematic research methods. Within Slovenia, excavations were often a result of chance finds or rescue operations by regional organizations, amateur archaeologists, and farmers which resulted in the destruction of sites, the crude collection of data, and materials left without any indication as to mortuary context. These excavations included work at various Urnfield graves near Maribor and at newly discovered cemeteries (Teržan, 1990: 16).

After the Second World War, during the socialist reconstruction of Yugoslavia, there was a generalized movement to create a new organization for the curation of artifacts, museology, and the profession of archaeology (Teržan, 1990: 17). The Archaeology Department at the Slovenian Academy of Sciences and Arts was soon established to allow for more permanent placement of professional archaeologists and transformed regional museums into state institutions (Teržan, 1999: 97-98). In 1948, a Bronze Age and Early Iron Age cemetery was discovered in the courtyard of the Academy. The number of excavations increased in the 1950s as new examinations were made at burial sites such as Ormož, Brinjeva gora, Ruše II, and Pobrežje (Teržan, 1990: 18; Teržan, 1999: 97-98). Work completed by H. Müller-Karpe in 1959 helped to supplement research on Slovenian archaeology, as it provided a systematic chronology for the Urnfield Culture throughout the southeastern Alpine, central European, and Mediterranean cultural systems (Teržan, 1999: 98).

Despite an increase in fieldwork at both mortuary and settlement sites throughout Slovenia, problems began to afflict the progress of archaeological research. This has been attributed to the vast quantities of unstudied excavated material and undeveloped methods in museum documentation, preparation, and analysis (Teržan, 1990: 18). Research collected from sites went unpublished and it was not until the 1960s when archaeological reports began to be written. During the 1970s, research was strengthened by the publication of the book *Arheološka najdišča Slovenije* (Archaeological Sites of Slovenia) which included a Neolithic and Eneolithic map with the location of 341 sites and a list of settlements, caves, burial sites, cemeteries, and isolated finds (Leben, 1979: 30; Teržan, 1999: 98; Dular & Tecco Hvala, 2007: 20). Excavations, publications, and research completed by archaeologists such as Stanko Pahič, Josip Korošec, Stane Gabrovec, and Biba Teržan have helped to substantiate the concept of Hallstatt cultural groups in Slovenia in addition to further investigating the late Urnfield Culture within the Southeast Alpine region.

3.3 Osteological Research of the Late Bronze Age

Despite advances in Slovenian archaeology, reports and publications regarding the demographics of Late Bronze Age populations are scarce. Only a few osteological analyses have been completed regarding Urnfield Culture remains from Slovenia. In 1975, F. Starè published the results of an anthropological study on a collection of 60 sets of cremated remains from the Late Bronze Age site of Dobova at Brežice in the Sava valley. Age was determined for all of the individuals. Fifty-five were determined to be adults with 23 of those individuals being assigned to the 'developing adult' stage; the remaining five individuals were determined to be children (Starè, 1975: 25). Sex was determined for only eight individuals, with four males and four females (Starè, 1975: 25).

An important study regarding Slovenian cremation burials was completed in 1990 by T. Tomazo-Ravnik. She completed an osteological analysis on eight grave units and one tumulus from Poštela, an Early Iron Age site located in eastern Slovenia. As described by Tomazo-Ravnik (1990: 373), the cremated remains were very poorly preserved and ranged in weight from 3 grams to 190 grams. Of the eight grave units, Grave 14 had possibly two individuals, as four cranial fragments were found in a separate section from the rest of the cremated remains and the author analyzed these separately. Of all the individuals analyzed from Poštela, no identification of sex could be made and including the potential additional individual from a separate grave (14), there were five adult individuals, four indeterminate, and one juvenile. Determination of age was established by thickness of cranial fragments and metatarsal fragments with most of the fragments being pale beige in color.

In 2008, M. Šlaus performed an osteological analysis on cremated remains from five graves from the Urnfield Period from the site of Gorice near Turnišče. Four of the five graves determined to have contained the remains of one individual and age and sex were determined for each cremation. Šlaus analyzed the remains for any pathological lesions and it was found that only the remains from Grave 4 exhibited any evidence of a pathological condition (Šlaus, 2010: 126). While it is discussed that moderate osteoarthritic changes were found on the joints, Šlaus does not include detail as to which joints were affected and the overall morphology of the lesions. Animal remains were discovered in two of the graves. Grave 3 contained only the well-preserved remains of a red deer and Grave 4 included fragments of an unidentified animal (Šlaus, 2010: 125-126).

As partly contemporary, although from a different cultural region, there are two other sites which can be discussed as providing important osteological information on human remains from Slovenia. In 1974, M. Urleb published the osteological data from the biritual cemetery of Križna gora located in the Notranjsko region in the southwestern Slovenia. A total of 153 graves with 62 inhumations were discovered, with only 36 of them having been analyzed (Urleb, 1974: 27). It was determined that there were 12 males, 7 females, and 6 children. Of the 12 males, four were considered to be over 50 years old, with the remaining 8 individuals aged between 20-40 years. Only one of the females was determined to be over 50, with the others aged between 20-40 years (Urleb, 1974: 27).

At the site of Tolmin in the Soča valley, 133 contained what was deemed as a sufficient amount of bone material for analysis; the remaining 154 graves were not included in the analysis (Ravedoni & Cattaneo, 2002: 115). In determining the minimum number of individuals, the authors analyzed the remains for the presence of any supernumerary skeletal elements which would reveal two or more individuals within the same tomb (Ravedoni & Cattaneo, 2002: 117). As the authors found that there were no duplicate bones or bones which would reveal the presence of two individuals (i.e. both adult and juvenile bones), each cremation assemblage was considered as containing the remains from one individual. It was reported that only 7%

of the cremation assemblages contained remains with pathological lesions; it was suggested by the authors that the infected regions may have been a result of a traumatic event (Ravedoni & Cattaneo, 2002: 119). Eighty-three percent of the bone material was determined to be grey in color, with 7% black and 10% white (Ravedoni & Cattaneo, 2002: 116). It was reported that there were varying degrees of deformation and fracturing to the remains, due to differential burning and exposure of the remains (Ravedoni & Cattaneo, 2002: 116).

3.4 An introduction to the Late Bronze Age of Eastern Slovenia

The chronological sequencing for the Late Bronze Age began with the recovery of artifacts that could be typologically categorized. The key sequencing for the Urnfield Culture which is still used today was created in 1959 by Müller-Karpe; although altered by several archaeologists and described as needing revisions by N. K. Sandars (as cited by Teržan, 1990: 21), Müller-Karpe's classification has provided the base for the creation of several interpretations of the chronological sequence of the Urnfield Culture in the Štajerska region.

The Late Bronze Age or Urnfield Culture period typically starts around 1300 B.C. and continues until 750 B.C. (Muller-Karpe, 1959: 155; Teržan, 1999: 100). This period in the southeastern Alpine region is characterized by extensive small village settlements built on or near terraces alongside tributaries, rivers, and river bends with extensive rural surroundings (Coles & Harding, 1979: 339; Bouzek, 1982: 184-185; Collis, 1984: 37; Teržan, 1999: 102; Winghart, 2000: 151; Bogucki, 2004: 88). Individuals with higher economic and social status tended to develop their settlements on elevated plateaus, in order to maintain a visual command over the lowland areas and villages (Coles & Harding, 1979: 340; Teržan, 1999: 102). Fortified settlements were constructed of earth and wood and were surrounded by ramparts or wooden fences (Dular & Tecco Hvala, 2007: 75, 79). Most forested areas were replaced with small agricultural communities and remaining land was maintained for grazing, fencing, and leaf foddering (Bouzek, 1982: 182; Wells, 1983: 2; Kristiansen, 1998: 104; Teržan, 1999: 103). Based on finds of agricultural tools, organic macroremains, pollen, and animal remains, it has been hypothesized that inhabitants were raising cereals such as wheat, barley, millet, and rye in addition to maintaining extensive stock-raising (Kristiansen, 1998: 106; Teržan, 1999: 103; Bogucki, 2004: 89; Dular & Tecco Hvala, 2007: 206, 209). It has been suggested that bees were also domesticated due to the need for honey as a sweetener, wax for the bronze casting process, and as the making of mead increased throughout the region (Milisauskas, 1978: 207). Cattle were the primary faunal resources, with goats, sheep, pigs, and wild game providing additional sources of subsistence (Milisauskas, 1978: 219; Teržan, 1999: 103; Bogucki, 2004: 89; Dular & Tecco Hvala, 2007: 211).

People were able to maintain their social status by controlling access to the river, raw materials, and trade routes. Ores were exploited from the mines throughout the region; copper sources are found in areas of western Austria, northern Italy, the eastern Alps, and the Pohorje Range of Slovenia (Mason, 1996: 4; Teržan, 1999: 102). Gold sources were used throughout this time period in order to create prestige goods; rock salt was also a highly valuable commodity used to enhance the flavor of food, preserve goods, in tanning, and in the maintenance of livestock (Wells, 1983: 152; Collis, 1984: 38; Teržan, 1990: 81; Mason, 1996: 6; Winghart, 2000: 157). With different regions producing different raw materials and finished products and the southeastern Alpine region controlling a large portion of the trade routes, there was heavy distribution of goods and raw materials such as copper, tin, silver, bronze, amber, faience beads, and sea shells throughout the area (Childe, 1930: 40, 210; Muhly, 1973: 187; Milisausaks, 1978: 219; Černe, 1993: 335; Jensen, 1997: 26; Teržan, 1999: 107; Pare, 2000: 24; Ruiz-Gálvez, 2000: 268; Winghart, 2000: 152).

The primary burial practice was to cremate individuals on a cremation pyre and then to place the remains in an urn and bury them in flat fields. Urns were occasionally placed within a grave and bronze prestige items such as fibulae and decorative pottery were often placed in or around the cinerary urn (Pahič, 1972, 3; Teržan, 1999: 111; Dular & Tecco Hvala, 2007: 193). As derived from this research, animals were often burned on the pyre with the individual; this included animals such as cattle, goat, sheep, horse, pig, which may have been owned by the person.

CHAPTER IV

MATERIALS AND METHODS

4.1 Materials

The primary interest in beginning this study was human osteoarchaeology in Slovenia. In addition to performing an osteological analysis, the author wanted to investigate the burial practices of the region of Štajerska (Slovenian Styria) while providing a comparative study regarding Late Bronze Age sites. As no reports or publications had been completed regarding a major analysis of cremated remains from the Urnfield Culture in the Štajerska region of eastern Slovenia, enquiries were made to ascertain whether any skeletal material could be acquired which would represent a large enough sample to be studied.

Waldron (1994) explains that sample bias is inevitable when dealing with skeletal populations due to both extrinsic and intrinsic factors which affect the selection of remains for study (Waldron, 1994: 12-16; Waldron, 2007: 29). The extrinsic factors affecting the size of the population from which a sample can be taken are: 1) the proportion of deceased individuals from the population which were buried at a specific area which is under study, 2) the proportion of skeletons which survive to discovery, 3) the number of individuals actually discovered, 4) and the total individuals actually recovered (Waldron, 1994: 12; Waldron, 2007: 28). Intrinsic factors include the age structure of the population and the stage of economic development in which the population lived; the more developed a society is economically, the longer people tend to live (Waldron, 1994: 16-20; Waldron, 2007: 31-32).

Aside from sample bias due to extrinsic and intrinsic factors, a major factor determining the population sample size for this study was the availability of cremations from different sites. A series of Late Bronze Age sites had been excavated from 1952-1993 and a collection of cremated remains had been discovered at each location. These cremations were curated at the Regional Museum of Maribor and available for study. In order to have an adequately sized population, all the bone assemblages from three major

Late Bronze Age sites were acquired; thus, the largest available skeletal sample for the Štajerska region was 169 cremations.

The sample population was excavated from three sites: Ruše, Gračič at Brinjeva gora, and Pobrežje. All three sites are characterized by cemetery burials in flat grave fields and have been categorized as Late Bronze Age sites. Graves from these sites tended to be shallow pits dug into the soil with a large stone or stone slab placed over the top; remains had been cremated and placed in an urn or scattered at the base of the pit with bones places in specific piles (Teržan, 1990: 56).

Twenty-six individuals were analyzed from the site of Ruše II. As discussed in Chapter 3, Ruše I was first discovered in 1875 and 1876, when 172 flat cremation graves were excavated by A. Müllner and G. Wurmbrand (Müller-Karpe, 1959: 115, 118; Mason, 1996: 42). In 1952, S. Pahič began his work on the site of Ruše and during this excavation a second cemetery (Ruše II) was discovered, containing 35 cremation graves (Pahič, 1957: 68; Mason, 1996: 42). In 1993, subsequent excavations continued at Ruše II as part of a salvage operation directed by Mira Strmčnik Gulič from the Maribor Regional Office of the Institute for the Protection of Cultural Heritage of Slovenia (Črešnar, 2006: 97). Material discovered from Ruše is considered typical of the Pannonian Urnfield regional group, also found in eastern Austria, western Hungary, northern Croatia, and northwestern Serbia (Mason, 1988: 212).

Located 680 meters above sea level on an elevated hilltop in the Pohorje Hill Range above the Dravinja River, the settlement site at Brinjeva gora and the associated cemetery of Gračič were first excavated by S. Pahič in 1953 and 1955 (Oman, 1981: 153; Kavur, 2007: 52; M. Črešnar, personal communication, March 2008). Analyses of excavated pottery have lead to the conclusion that Brinjeva gora was densely populated during the Hallstatt A/B period of the Late Bronze Age; however it would appear that the settlement was concentrated mainly on the periphery of the hillside during the Ha A period but covered the entire slope during the Ha B period (Pahič, 1962-1963: 357; Pahič, 1981, 71-143; Oman, 1981: 153). Sixty-six cremations from Gračič at Brinjeva gora were analyzed as a part of this study.

The site of Pobrežje is located within the Drava River valley. It was excavated in 1936, 1939, 1952-1964 and 1973 consisted of 178 cremation graves (Pahič, 1972: 7-9; M. Črešnar, personal communication, October 2009). This site may have been one of the important centers in Styria as groups would have been able to control trade routes within the surrounding area. This site is located in the Drava River valley and is considered to have been a small village group based on the burial population of 31 individuals per 25 year generation (Mason, 1996: 85) and despite a large number of graves being uncovered, many were ruined during fieldwork. The location of Pobrežje at the point where the Drava River flows out of the Alps into the valley was considered to be an important social and economic center within Central Europe. Seventy-seven cremations were available from Pobrežje.

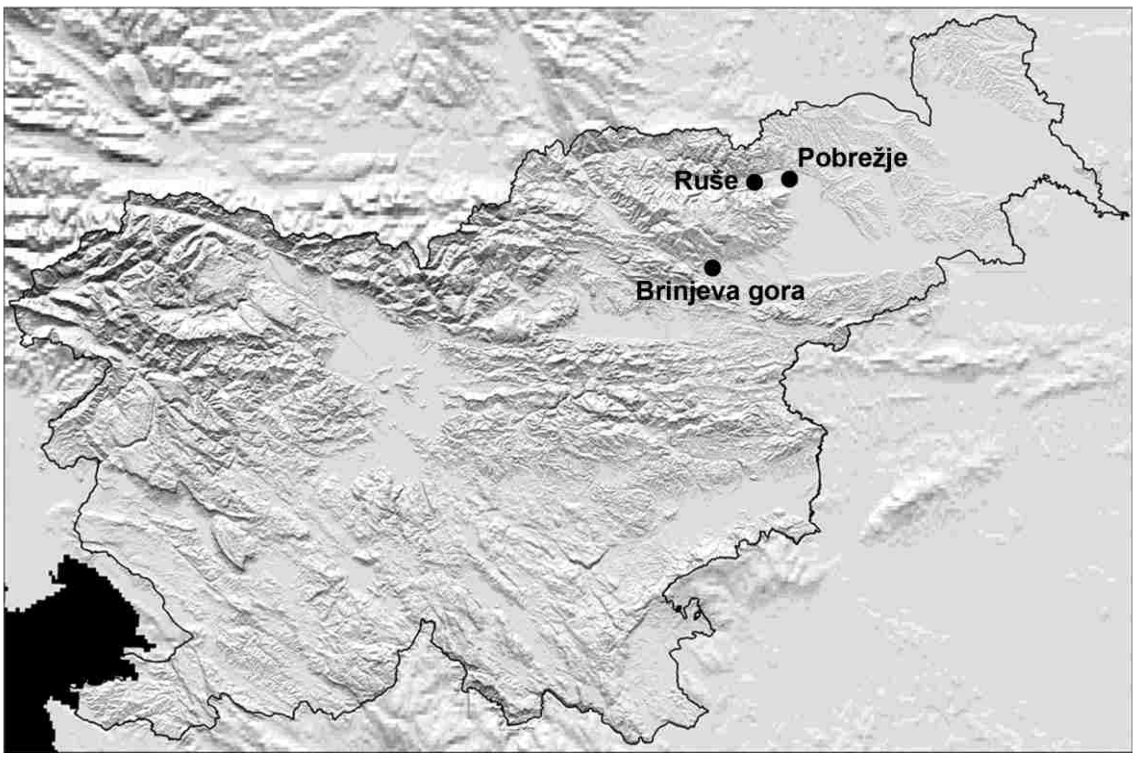

Figure 1. Selected Urnfield Culture sites from eastern Slovenia (M. Črešnar, personal communication, July 2009).

Condition of the Remains

During excavation, burial numbers were assigned to the remains and the bones were then placed into labeled paper envelopes and further stored into large cardboard boxes. This was the condition of the remains when they were delivered to the author at the University of Ljubljana. The author took three separate trips to Ljubljana to complete the analysis of the remains. Upon careful analysis of the paper envelopes stacked in the boxes, it was clear that many of the bones had fallen out of their envelopes and were commingled with the remains from other graves. Many of the labels on the envelopes had faded and several of the graves contained more than one envelope of bones. Several of the burials included additional envelopes with labels including supplementary information such as 'Grave 14' and 'Grave 14B'. The remains from each of these different envelopes were treated separately in order prevent the potential commingling of the remains of multiple individuals.

The burial numbers for each site could not be verified with information from the site reports in all three cases as the site report for Brinjeva gora was not published and is not available to researchers. The site reports which were consulted indicated that there were more burials discovered during excavation than were present for analysis. The absence of these remains for study has been attributed to disposal, misplacement, and poor excavation techniques.

4.2 Methods for Cremation Analysis

During the 1990s, standardized techniques for analyzing a set of cremated remains were established. This procedure was developed primarily by cremation expert Jacqueline McKinley and is thoroughly discussed several of her publications (McKinley, 1989: 65; McKinley, 1993: 283; McKinley, 1994b: 5; McKinley & Roberts, 1999: 7-8; McKinley, 2004: 9-13). The process begins out in the field with the initial excavation of the remains. Urns first receive a specific urn number and are then plotted and mapped in relation to the surrounding grave. If discovered damaged, the urns are excavated in situ as opposed to being excavated once removed from the grave. Bones extracted from the urn are then individually dry brushed in order to remove adhering soil. If necessary, bones are washed in cool water, but not submerged to prevent long-term drying of the bones and further disintegration (McKinley & Roberts, 1999: 7-8). If possible, it is important to separate and record the fragments as they are removed from the urn in order to prevent breaking and subsequent difficulties with identification (Duday, 2009: 146).

After initial cleaning, bones are sorted through so that all grave goods, stones, and organic material are removed. The cremated remains would then be passed through a stack of sieves with mesh sizes of 10 mm, 5 mm, and 2 mm. This separation allows for a degree of bone fragmentation to be assessed as weights are collected from each size category. After being weighed, the bones are then sorted into categories based on specific skeletal element. Animal bones, which are denser and heavier than human bones, are removed at this stage from the assemblage.

While it is not possible to assign every fragment to a specific bone, the majority of the remains are labeled under general categories such as "long bone." In situations where it is unclear from which bone the fragment comes from, the fragment is placed into the "unidentified" category instead of risking possible error. After being placed into specific skeletal element categories, each fragment is assessed and any information regarding age, sex, pathologies, trauma, fracture patterns, coloration, and condition is gathered into a database. The weight of each skeletal element category is taken and the overall weight of identified bone is compared with that of the total cremation weight. This provides an indication of the degree of fragmentation in addition to the percentage of bone which was identifiable and thus able to provide additional information. At this stage, these weights may be used to indicate any potential bias in which areas of the body were extracted specifically from the pyre for burial (McKinley, 1989: 68).

After all information has been gleaned from the human remains, the animal bones, if present, are assessed in order to categorize them to a specific skeletal element and then possibly to a specific animal. The weight of animal bone is compared with that of the human bone and it is important to remember that in the "unidentified" category of human remains, there may be several unidentifiable animal bone fragments which have been mixed in with the human bone fragments.

For this specific research project, the author employed the majority of the standardized methods, when possible. As the remains were first discovered at the sites decades ago, the author was obviously not able to partake in the discovery and subsequent excavation of the remains. At the start of the laboratory analysis, the cremated remains and all additional materials from each burial were emptied out of the paper envelopes in which they had been previously stored and placed into separately labeled containers in order to avoid any commingling of remains from different graves. The bones from many of the cremations were in poor condition and had been reduced to extremely small fragments. This was most likely due to burning-related fracturing, although post-excavation damage, handling, and curation methods may have played a role in the further fragmentation of the remains. At this point, the author realized that as a result of a slight miscommunication with a fellow colleague, the needed stack of sieves were unavailable. This proved to not be an insurmountable problem, as a set of sieves with the proper mesh sizes was constructed for use. All materials from each grave were then passed through a series of sieves one at a time and bone dust and fragments > 2 mm were collected and set aside. After placing the bones into their respected size category, bones were gently dry brushed with a soft toothbrush in order to remove adhering soil and dust. If dry brushing did not remove the attached soil and the bones were not liable to break with additional cleaning, they were washed and set out for three days to ensure that the bones dried out thoroughly. After bones were cleaned and in certain cases dried, the cremations were examined and all grave goods (i.e. pieces of pottery, urn fragments, bronze or iron artifacts), organic materials, and stones were removed from the assemblage. The bones were weighed by size to 0.01 grams and a fragmentation percentage was calculated for each cremation.

After calculating the weight of the cremated bones by size, each bone was examined and separated into categories based on skeletal element and any animal bones discovered were extracted for a separate analysis. Each group of identifiable bones separated by skeletal element was then weighed to 0.01 grams. After sorted into piles by skeletal element, an analysis of each bone fragment commenced, with the author noting completeness, post-excavation damage, side of the body from which the bone came, age, sex, specific bone feature, color, fracture pattern, any signs of pathologies, or unusual characteristics. Metric techniques were only employed when fragments were apt to provide significant information. Once this analysis was complete, bones were sealed into labeled polythene bags for future storage. Data collected were initially written in narrative form and then organized subsequently into a series of spreadsheets. This information can be found in the Appendices I and II.

4.3 Osteological Methods

Accurate age and sex determinations of human skeletal remains are essential to any osteological analysis. The identification of an individual's age and sex can provide insight into past environmental adaptations, population dispersal, diet, disease, activity patterns, and mortuary practices (Buikstra & Ubelaker, 1994: 15). Although there are two main methods used to determine the sex of an individual, anthroposcopic (visual) and metric assessment, an osteologist can only rely on visual assessment when bones are too fragmentary for metric analysis and generally do not have the landmarks needed from which to make accurate measurements.

Although the age and sex of a cremated individual is obtained using the same methods as for unburned individuals, assessing demographics can be a daunting task for the osteologist, as the determination depends on the presence of sexually dimorphic or age-defining characteristics within the assemblage. For determining the age of a juvenile or adolescent, unerupted tooth crowns are frequently discovered intact, being protected from the heat and fire by their position on the interior side of the mandible (Wells, 1960: 31; Dzierzykray-Rogalski, 1966: 43; Merbs, 1967: 501; McKinley, 1989: 69; McKinley, 2000: 409). It is important to recognize that erupted teeth generally cannot be used as an indicator of age, as the enamel tends to expand and shatter once exposed to heat (Wells, 1960: 33; Merbs, 1967: 498; McKinley, 1989: 69; McKinley, 2000: 410; McKinley & Bond, 2001: 285). Although surviving tooth roots can provide a cutoff point for juveniles vs. adults based on tooth root closure, the root must be identifiable or age cannot be established accurately.

As with unclosed/closed tooth roots, bone degeneration, and fused or unfused epiphyseal ends, the size of bones can also provide a generalized age range for an individual, provided that the fragment can be identified to a specific skeletal element. Skull fragments often survive with joining cranial sutures; the degree of openness can provide an estimate range of age (Buikstra & Ubelaker, 1994: 32). Gejvall states that when determining the age of a cremated individual, after using tooth roots, vault thickness, degree of sutural obliteration, and weight of the sample to its volume, it is dangerous to attempt a determination of age over 21 years old (1969: 473). As such, the osteologist often forced to use terms such as ‘adult’, ‘juvenile’, or ‘unknown’, depending on which fragments are available for analysis and adult age range can end up being very broad and overlapping (McKinley, 2008c: 172).

When analyzing a cremation, often the osteologist must attempt to determine the age and sex of an individual based on a single bone fragment. It is important for the osteologist to not only understand the various stages of age development, but also to understand how each skeletal element changes as an individual grows older and which fragments, if present, may be helpful in aiding an accurate determination of age.

Age Determination

Despite the overall acceptance of the standard ageing methods, there are several factors which may affect the reliability of the determined age range. O’Connell discusses various intrinsic and extrinsic factors which affects the skeletal age determination; this includes ancestry, sex, occupation, lifestyle, nutrition and overall health, and economic status (O’Connell, 2004: 20). As there will always be overlap in the normal distribution of skeletal growth and development within a population, it is important to keep in mind that the methodology utilized may not be able to provide an exact age of the individual, but rather a broad age range.

The methods used to determine age are considered standard in the osteological field and have been widely discussed (van Beek, 1983; Buikstra & Ubelaker, 1994;

Bass 1995; Steele & Bramblett 1998; Scheuer & Black, 2000; Byers, 2002; Scheuer & Black, 2004; White & Folkens, 2000; White & Folkens, 2005). Other methods utilized are discussed below.

Epiphyseal fusion

Epiphyseal fusion is one of the most commonly used methods of determining the age of an individual. Located at the ends of long bones and at some major margins and processes is a secondary bone-forming center which ossifies to the main bone after a certain period of development (Buikstra & Ubelaker, 1994: 179; Byers, 2002: 208). By analyzing the progress of development or fusion of this epiphysis to the bone, the osteologist can make a determination of age by referencing the approximate times of fusion. The following table (Table 4) provides a list of each skeletal element in association with the approximate times of fusion used by the author when determining the age of the individuals (Brothwell, 1981, p. 66; White & Folkens, 2000).

Bone	**Feature**	**Time of Fusion**
Scapula	Glenoid fossa, acromion process	17 years – 22 years
Scapula	Vertebral border	17 years – 22 years
Clavicle	Medial end	18 years – 30 years
Vertebra	Vertebral ring	20 + years
Humerus	Proximal end	16 years – 25 years
Humerus	Distal end	13 years – 19 years
Ulna	Proximal end	13 years – 19 years
Ulna	Distal end	15 years – 23 years
Radius	Proximal end	13 years – 19 years
Radius	Distal end	15 years – 23 years
Metacarpals/Phalanges	Proximal/distal epiphyses	14 years – 21 years
Pelvis	Iliac crest	16 years – 23 years
Pelvis	Ischial tuberosity	17 years – 25 years
Pelvis	Ilium-ischium-pubis	13 years – 16 years

Table 4. Skeletal elements and their associated time of epiphyseal fusion.

Bone	Feature	Time of Fusion
Femur	Proximal end, greater trochanter	15 years – 20 years
Femur	Distal end	16 years – 23 years
Tibia	Proximal end	16 years – 23 years
Tibia	Distal end	16 years – 20 years
Fibula	Proximal end	16 years – 23 years
Fibula	Distal end	16 years – 20 years
Metatarsals/Phalanges	Proximal/distal epiphyses	14 years – 21 years

Table 4 cont. Skeletal elements and their associated time of epiphyseal fusion.

Cranial Thickness

Another method which was considered by the author when attempting to establish age of the individuals was based on cranial vault thickness. Grieve et al. reports that infant skulls average between 1 and 2 mm in thickness while adults vary between 5mm and 8 mm in thickness (Adeloye et al., 1975: 26; Grieve et al. 2003: 1598). While other studies have attempted to associate cranial thickness with specific ages, there appears to be no statistically consistent correlation with skull thickness and a definite age range, aside from the general concept that adults have thicker skulls than infants and young children (Todd, 1924: 256; Letts et al., 1988: 279; Lynnerup, 2001: 46; Lynnerup et al., 2005: 1).

For each individual, the author used a set of sliding calipers to measure the cranial thickness of the largest skull fragments. Individuals with cranial thickness measurements above 5 mm were considered to be adults and those below 2 mm were considered to be infants. Individuals with cranial thickness measurements of 3 mm to 4 mm were queried as adults since it is unknown whether these measurements could be of younger or smaller adult individuals or larger adolescents.

Cranial Suture Closure

One method which was utilized by the author to determine the approximate age of the individuals was cranial suture closure. Studies of the cranial suture first began in the middle of the nineteenth century and early researchers discovered a positive correlation between suture closure and increasing age (İşcan & Loth, 1989: 24; Harth et al., 2009: S186). Similar research was completed in the 20th century by several researchers who also determined that cranial vault sutures remained open in young people, but tended to close until the sutures were completed obliterated in old age (Byers, 2002: 223; Meindl & Lovejoy, 1985: 29).

Despite the fact that cranial sutures fuse with increasing age, there can be considerable variability in the closure rates (Buikstra & Ubelaker, 1994: 32; Byers, 2002: 225). In using cranial suture closure as a viable age determination method, different stages of closure were established which allowed for age at death to be assigned in broad categories. These stages were developed by Buikstra & Ubelaker and were employed by the author when attempting to narrow down the age range of the individual.

During the osteological analysis, cranial fragments with intact sutures were examined by the author and categorized according to Buikstra and Ubelaker's stages: 1) open; 2) minimum; 3) significant; and 4) obliterated. The individual was then assigned to one of the three major categories of adulthood: young, middle, and old. While this method did not permit precise age estimation, it was useful in indicating the approximate period in adulthood for certain individuals.

Dental Development

Teeth begin growing by the deposition of enamel and bone material, starting at the tips of the cusps and growing back into the roots (Byers, 2002, p. 199; White & Folkens, 2000, p. 115). At birth, all deciduous or baby teeth have mineralized and by 1 year of age, several of the permanent teeth having started to develop (Scheuer & Black, 2004, p. 164). By 3 years of age, all deciduous teeth have erupted and completed root formation (Scheuer & Black, 2004, p. 164; Steele & Bramblett, 1988, p. 102; Ubelaker, 1978, p. 47; van Beek, 1983, p. 131). Starting at approximately age 7, deciduous teeth are shed and permanent teeth begin to erupt into the mouth. By 11 years of age, the majority if not all deciduous teeth are lost, with the permanent dentition in various stages of completion and the 3rd molar having started forming. By 15 years of age, all permanent teeth are complete except for the 3rd molar which completes root formation by 21 years of age.

As discussed previously, during a cremation the enamel of the tooth shatters, leaving only the root. Despite missing the crown, a determination of age can still be obtained using the development of the root or the completion of tooth sockets. The author utilized the following progression chart when attempting to assess age at death from the surviving roots.

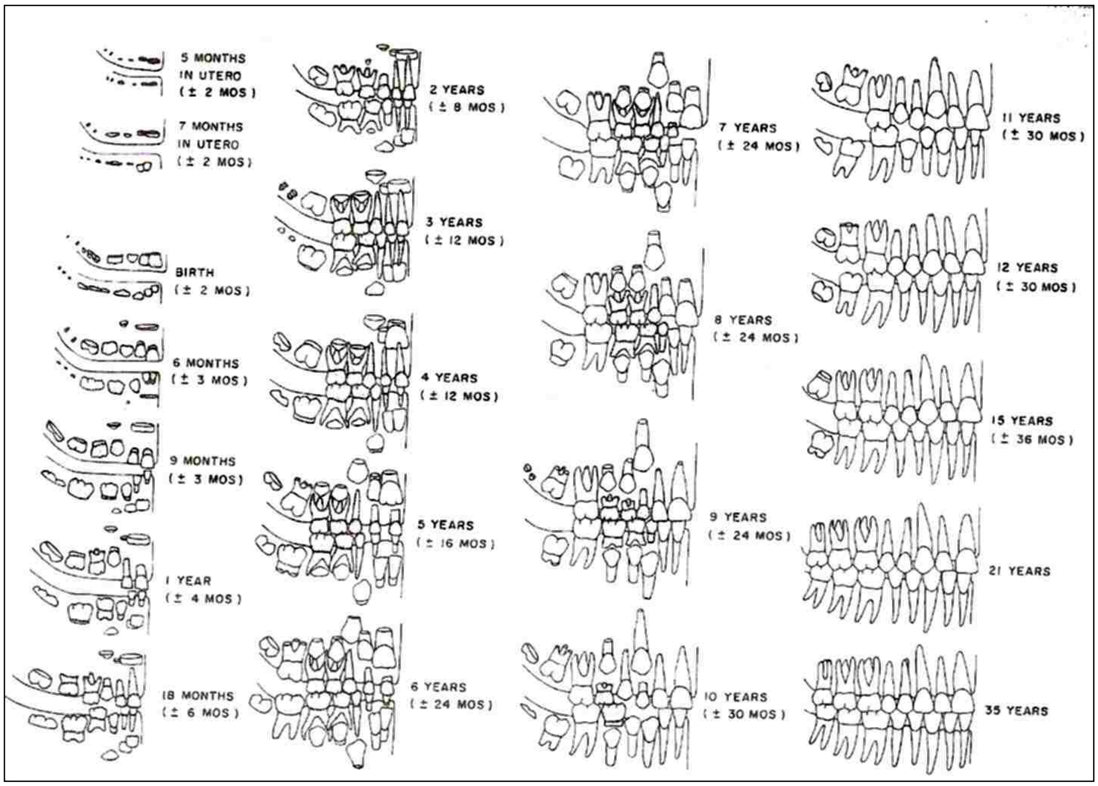

Figure 2. Dental progression chart (Ubelaker, 1978, p. 47).

Bone Development

In certain cases when analyzing a cremation, there are not any specific features or characteristics which would aid in narrowing down an estimation of age. In this situation, the osteologist must assess the development of the bone fragment and may end up only being able to place the individual within an age category. The seven major stages of age development which were utilized by the author are based on El-Najjar and McWilliams' age classifications as discussed in Steele and Bramblett and are as follows: fetus, infant, early childhood, late childhood, adolescent, young adult, middle adult, and old adult. Individuals who could not be assigned to a specific category but were not considered "adult" were assigned as "juvenile." These age ranges and methods of determining age are all derived from the methods and categories established by various authors within the field of osteology (van Beek, 1983; Bass, 1995; Buikstra & Ubelaker, 1994; Steele & Bramblett, 1988; White & Folkens, 2000; White & Folkens, 2004; Chamberlain, 2006: 16-17).

Auricular Surface

A feature of the pelvis which was utilized by the author in determining the age of several individuals was the auricular surface. In 1985, Lovejoy et al. developed a new method for determining age at death based on the chronological changes of the auricular surface (Lovejoy et al., 1985b: 15; Byers, 2002: 217). They determined that the auricular surface of a younger individual exhibits a billowy surface with a granulated texture and with increasing age, the surface becomes dense and porous with lipping from degenerative joint change around the margins of the features (Lovejoy et al. 1985a: 10; Buikstra & Ubelaker, 1994: 25; Byers, 2002: 219; White & Folkens, 2000: 355). A set of stages were developed by Lovejoy et al. which described the chronological progression of the auricular surface as age increases. For this project, the author analyzed the condition of the auricular surface and compared it with the established phases to obtain the approximate age of the individual.

Sex Determination

With cremated human remains, bones are usually too fragmented to be used in metric analysis for sex determination, causing the osteologist to rely on anthroposcopic methods. When estimating the sex of an unknown individual anthroposcopically, the sexually dimorphic features analyzed are based on size and architecture (Buikstra &

Ubelaker, 1994: 16; Byers, 2002: 171). In determining the sex of the individual, certain sexually dimorphic features must be present in order to provide an accurate identification of sex and this can be largely depnded on the quantity and quality of bone available (McKinley, 2008c: 172). Correia and Beattie (2002: 444) and Gejvall (1969: 474) suggest using the size and robusticity of bone fragments as a major indicator of sex with the characteristics strongly manifested being typical of males. Gejvall also includes a reference to some of his prior work, in which he tested the hypothesis that the walls of female bones would be 1/3-1/4 mm thinner than male bones and discovered that there was statistical proof that a statistical difference occurs between the size of the walls of male and female bones, females' being markedly smaller (Gejvall, 1969: 476-477). Although generally accepted that males are larger than females, it is important to keep in mind that in every population there will be individuals with indeterminable sexual features and due to this fact, there will always be individuals that cannot be accurately sexed despite sexually dimorphic fragments being present (Gejvall, 1969, 474-475).

Mays comments that as the method of sex determination for cremated remains is the same as that for uncremated remains and states that if sexually diagnostic features are not available, then the osteologist must rely on the general size and robusticity of the bone fragments, keeping in mind that fragments may have shrunk during the cremation process (Mays, 1998: 215). McKinley reports that it is not uncommon to attribute sex to less than 50% of the population under study (McKinley, 2008c: 172). As discussed before, while it is imperative to keep possible shrinkage rates in mind, it is impossible to obtain the exact percentage of reduction for each bone fragment without knowing the dimensions of the bone prior to burning. Males are approximately 8% larger and more robust than females; however, size differences between males and females can be minute, depending on the degree of sexual dimorphism within the population (Steele & Bramblett, 1988: 53; Byers, 2002: 171; White & Folkens, 2005: 386). Normal variation within a population produces small, gracile males and large, robust females. These individuals fall towards the center of the distribution where cranial traits that distinguish males and females overlap and an accurate determination of sex becomes more difficult (White & Folkens, 2000: 363; Byers, 2002: 179).

It is important to keep in mind the fact that the use of cranial features in determining sex is complicated by age-related changes in dimorphism during adulthood (Buikstra & Ubelaker, 1994: 16). Women, generally aged over 50 years, tend to develop masculine traits due to the lack of estrogen from menopause (Walker, 1995: 36; Brickley & McKinley, 2000: 24). As discussed before, normal variation within a population can cause potential sexing problems as men may exhibit more characteristically female traits with women having more typically male features.

While the same methods of sex identification can be considered when determining the sex of a juvenile individual, it is a more difficult task as there are no set standards for diagnosing sex in adolescent remains. During the adolescent period, males and females mature at different times and at different rates, with the growth spurt occurring at varying times in also individuals of the same sex (Scheuer & Black, 2004: 19). Children exhibit female characteristics before the onset of puberty. It is not until the influx of testosterone during puberty that male skeletons begin to acquire typically male characteristics (McSweeney, October 15, 2008, personal communication).

Although there are slight morphological differences between males and females at an early age, the differences are not clear enough for a reliable determination of sex to be asserted until after the modifications of puberty take place (Scheuer & Black, 2000: 12; Scheuer & Black, 2004: 20). As a result, a determination of sex was not attempted for any of the juvenile individuals.

Determining sex based on various cranial and pelvic features can also be subjective, which can lead to discrepancies between osteologists. Although several scoring systems have been created to help alleviate the confusion between ‘typical’ male and female characteristics, anthroposcopic assessments are based on the individual observer’s discretion, which is influenced by experience working with remains, the condition of the bones, and the completeness of the skeleton.

In determining the sex of cremated individuals, the degree of accuracy may narrow considerably depending on the amount of the body which is available for study. With small assemblages, there may be only one or two sexually dimorphic features present, which may give an indication of the sex of the individual; however, the use of only one feature decreases the accuracy of the determination. The methods used to determine sex have been widely discussed and other methods used by the author are discussed below (van Beek, 1983; Buikstra & Ubelaker, 1994; Bass 1995; Steele & Bramblett 1998; Scheuer & Black, 2000; Byers, 2002; Scheuer & Black, 2004; White & Folkens, 2000; White & Folkens, 2005).

There were only three sexually dimorphic features of the skull and two features of the pelvis which were utilized by the author in estimating the sex of the individuals from this study. These features were the supraorbital margin, the browridges, and the external occipital protuberance of the skull and the greater sciatic notch and the presence or absence of the preauricular sulcus of the pelvis. These characteristics were assessed visually and then an estimation of age was determined based on the development and shape of the features.

There was only one bone fragment which was complete enough to obtain a measurement by the author. From one of the individuals, the diameter of the radial head was taken. This measurement was then compared with established maximum and minimum diameters for the radial head based on Berrizbeitia's 1989 study on sex determination using the radius and an assessment of sex was made.

Stature

Determining the stature from cremated remains is virtually impossible, as adequate long bone shafts do not survive cremation, which could have been used in statistical equations using diameter measurements (Merbs, 1967: 498). The sex of the individual, which often cannot be determined, must also be known in order to use the proper set of equations (McKinley, 1989: 71). Potential shrinkage rates must also be kept in mind, so that even if an approximate determination of stature were obtainable, shrinkage of the bone fragments would alter the final height estimation. As a result, no measurements were taken by the author that would have allowed for a determination of stature to be made.

Identification of Pathologies

In studying human remains, one factor which must be analyzed for and recorded appropriately is the presence of any pathological lesions or signs of trauma. McKinley (1989) comments on the frequency of discovering pathological lesions on fragments of cremated bone; these lesions often take the form of osteoarthritis, dental disease, cysts, and exostoses (Wells, 1960: 31; Lisowski, 1968: 82; McKinley, 1989: 74). She mentions that although pathological lesions can often provide the osteologist with information regarding the health and general lifestyle of a population, it is not recommended to do so with cremated remains due to the fragmentary and often incomplete recovery of the skeletal remains (McKinley, 1997: 131). She also states that it is also not possible to make an accurate identification as to the diagnosis of the disease due to the absence of sufficient information (McKinley, 1997: 131; McKinley, 2000: 413). Herrmann supports this statement and also explains that due to the marked degrees of warping and deformation which can occur at high temperatures of firing, certain pathologies can be difficult to recognize (Herrmann, 1977: 101).

The initial step in recording bone or tooth pathologies is to include a detailed description of any abnormal lesions or areas of irregular growth (Roberts & Connell, 2004: 34). After providing details as to the appearance of the lesion, it should be noted on which bone or tooth the lesion occurs and where the abnormality is located. Further information should be included regarding the type of lesion and whether or not it is active, healed, or in the process of healing (Roberts & Connell, 2004: 35). Finally, the distribution pattern of the lesion and any potential diagnoses should be discussed (Roberts & Connell, 2004: 35).

Despite this recognized methodology, there are problems which arise when attempting to assign a ‘diagnosis’ to an individual. Several diseases may cause the same symptoms to appear on the bone and unless the full range of symptoms is present, the osteologist will have to include all of the likely infectious causes. Establishing an accurate diagnosis may also become extremely difficult if only a partial skeleton is present. In working with cremated remains, it is uncommon for the entire individual to be included in the burial, causing bones with potential lesions or fractures to be left out. Changes may occur to the infected bones due to high temperatures of firing, post-burning handling, excavation, and post-excavation curation. These changes contribute to the degradation of already fragile bones, which affects the condition of the remains and thus, the diseased areas.

Once the lesions have been recorded and a list of diagnoses compiled, it is important to reference various characteristics of each individual with the pathological changes. Factors such as age, sex, the environment, and social status may play a critical role in the prevalence of certain diseases and it is imperative that these aspects be considered so that suggestions can be made regarding explanations for the pathological changes (Roberts & Connell, 2004: 39).

During the osteological analysis, the author recorded data regarding any abnormal lesions or areas of irregular growth, making a note of which specific fragment and area of the body the abnormality was located. After describing the nature and location of the lesion or abnormality, potential diagnoses were researched and demographic information for each individual was referenced in order to provide a potential explanation for each pathological change.

Number of Individuals

While determining the number of individuals within a cremation, it is important to look for identifiable fragments that would indicate multiple individuals, e.g. the presence of immature and adult remains or the presence of multiple singly-occurring bones. However, one must take care to ensure that the presence of duplicate bone fragments and/or commingled adult and juvenile remains truly represents a multiple cremation, rather than a case of pyre re-use or site disturbance (McKinley, 1994b: 6). This would suggest that when trying to determine the number of individuals, the researcher must have access to site reports, maps, and drawing in order to document any intrusive bone fragments or areas of disturbance.

The composite weight of the skeletal bone fragments can also provide an indication as to the number of individuals present, but cannot be entirely relied upon. In most archaeological cases, collection of the entire cremated individual is rare and there may be complications deriving from the presence of animal bone being mixed in with the human bone (Lisowski, 1968: 82; McKinley, 1989: 69; McKinley, 1997: 132; McKinley & Bond, 2001: 287). As the entire weight of the cremation represents the total bone weight collected from the pyre for burial, it is important to keep in mind the possibility of post-burial disturbances and the degree of fragmentation may reflect disturbance of the size, pyre technology, or post-excavation handling (McKinley, 1989: 67).

Lisowski (1968) discusses how the weight and volume of a cremated individual is too variable for any accurate conclusions to be made (Lisowski, 1968: 79). He explains that infant cremations can be identified due to the light weight of the material, small volume, and small amount, with adult cremations being obviously larger and heavier (Lisowski, 1968: 79). He continues by stating that although a cremated individual may weight up to 2000 grams, a cremation may also weigh as little as 10 grams with the latter possibly being interpreted as the division and subsequent deposition of the remains to other areas (Lisowski, 1968: 79-80).

4.4 Animal Bones

Burned animal bones have been found in cremations from all periods throughout the world. In most instances, the quantities of animal bone recovered are small and have been considered to be food to sustain the dead into the afterlife (McKinley, 2006: 83). One main reason behind the diminutive quantities of animal bones recovered may be due to misidentification in the field. Whyte (2001: 437) explains that confusion may arise during an excavation as there is no manual for field identification of burned human bones. While this is true, the main problem stems from the fact that osteologists are normally not present during an excavation. If bones are not recovered specifically from an urn, cremated animal remains may be misidentified and interpreted as burned refuse. Information regarding burial rituals and mortuary practices can also be lost if during analysis, the animal bones are not set aside for future analysis. While a human osteologist may be able to determine from which specific bone certain fragments are from, he or she is usually not trained in the identification of a particular animal or species. Thus, a zooarchaeologist is needed to provide further information regarding potential bias in age or sex of the animals selected for cremation and subsequent burial.

For this research, the author identified the animal bones based on non-human features and the density of the bone fragments. Several of the bones were non-human and easily recognized as animal. As animal bone is denser than human bone, the author was able to identify fragments based on the weight of the bone. Bones identified as animal or possibly animal were separated from the assemblage of human bone and then taken to the Scientific Research Center at the Slovenian Academy of Sciences and Arts in Ljubljana where they were identified, if possible, to species by zooarchaeologists Dr. Borut Toškan and Janez Dirjec.

CHAPTER 5

RESULTS

This chapter presents the results of the osteological analysis in addition to three tables which contain the osteological data from the cremated remains from Ruše, Brinjeva gora, and Pobrežje. These tables include the associated grave number, the total weight of the cremated bone, the proposed number of individuals, the age and sex of the individual, any identifiable pathologies, and any animal remains that were included in the burned assemblage.

5.1 Number of Individuals

The remains from 169 cremated bone assemblages were examined for this study. During the initial stages of analysis, it was assumed by the author that unless duplicate bones were identified, each assemblage comprised the bones of one individual. No duplicate bones were discovered and there were no bone fragments from one urn that had differences in age that would indicate more than one individual, i.e. fully developed adult bones vs. immature juvenile bones. However, after further analysis, the possibility arose that several of the bone assemblages may include the remains of multiple individuals since the assemblages all contained incomplete skeletons. There was nothing specific that would have indicated that any of the assemblages could be matched together as containing the separated remains of one individual. As a result, the bones from each assemblage were considered to be from one individual and recorded as such, making the total number of individuals analyzed 169.

5.2 Age of Individuals

Out of the 169 cremations analyzed, an approximate age could be established for 124 individuals or 73% (Table 5). The remaining individuals could not be aged, due to the absence of age-related features which would have allowed for a determination to be established. The lack of these features is directly related to the small amounts of bone collected from each individual. Many of the age determinations which were established were based on one or two fragments and while having fewer fragments with which to determine age may narrow the degree of accuracy, it was important to try and glean all possible information from the remains present.

Site	No. with Assigned Age	Total Individuals
Ruše	16	26
Brinjeva gora	46	66
Pobrežje	62	77
Total	**124**	**169**

Table 5. Age determinations per site.

The above table shows the number of individuals from each site which were assigned an age at death. From Ruše, 16 out of 26 individuals or 62% were assigned an approximate age at death. At Brinjeva gora, 46 out of 66 or 67% have been assigned an age at death. From Pobrežje, 62 out of 77 individuals or 81% were assigned an age at death. There was a higher percentage of individuals assigned a determination of age from Pobrežje due to the increased number of cremations with fragments exhibiting age-related features. From all three sites, a total of 124 individuals out of 169 or 73% were assigned an age at death.

Tables for each site were created which shows the maximum minimum age for each grave with the bone and corresponding criteria from which a determination of age could be obtained (Tables 6-8). For many of the individuals from all three sites, two types of age determinations were included; these were provided to show the minimum age the individual could be at death and an overall age category. The two ages were only included if the remains contained skeletal elements where two ages could be obtained. For example, the assemblage from grave 16 at Ruše has been aged at 16+ years and 'adult'. Within the assemblage, there was a fragment of a fused distal tibia, which fuses at 16 years of age; thus providing the lowest age the individual could have been at death. While no maximum age could be established, the cranial skull fragments reflected development of an 'adult as they were over 5 mm in thickness'; thus the age of the individual was at least 16 years, but could be an adult at any age. Although these methods have provided a minimum age, many individuals must be categorized as "adult" owing to the absence of other skeletal features which would assist in narrowing down or clarifying the age range.

Grave number	Age	Bone	Criteria
4	Adult	Skull	Cranial thickness
10	Young adult	Skull	Moderately open cranial suture
11B	Infant	Skull	Cranial thickness
13	15+ years	Femur	Epiphyseal fusion
16	16+ years/Adult	Tibia; skull	Epiphyseal fusion; cranial thickness
18	14+ years/Adult	Phalanx; skull	Epiphyseal fusion; cranial thickness
19	15+ years	Humerus	Epiphyseal fusion
20	20+ years	Vertebra	Epiphyseal fusion
21	Adult	Skull	Cranial thickness
26	Adult	Skull	Cranial thickness
29	14+ years/Adult	Metatarsal	Epiphyseal fusion; bone development
29(2)	Adult	Scapula	Bone development
86	Under 23 years	Pelvis	Epiphyseal fusion
8	17+ years	Scapula	Epiphyseal fusion
9	Adult	Skull	Cranial thickness
32	21+ years	3rd molar	Erupted and fully formed

Table 6. Ruše individuals: Indicators of age at death.

Table 6 shows the 16 out of 26 individuals from Ruše which were assigned an age at death. The individual from Grave 4 was determined to be an adult based on an overall cranial thickness of 5 mm.

Grave 10 had one fused proximal end of a hand phalanx, which provides a minimum age of 14 years. This cremation also has one cranial fragment with a moderately open cranial suture. Based on the morphology of the cranial suture, this individual is identified as a young adult.

The remains from Grave 11B were determined to be from an infant. The cranial fragments are very thin, ranging from 1.5 mm to 3 mm and the other bone fragments are very small. The only bone from Grave 13 that could be used to estimate age at death is the fused femoral head, indicating that the individual died at 15+ years of age.

Grave 16 contained several bones from which a minimum age can be estimated. Based on an average cranial thickness of 5-6 mm, this individual is an adult. The fused distal end of the humerus is present which indicates an age at death of 13+ years. A fused metacarpal provides an age of 14+ years, and the fused lesser trochanter of the femur indicates an age of 15+ years. The fused distal end of the tibia provides the highest minimum age for the individual at 16+ years of age.

From Grave 18, there is a fused coronoid process of the ulna, suggesting an age of 13+ years, and a fused phalanx indicating 14+ years. Cranial fragments from this cremation are 4.5 mm in thickness, which are characteristic of an adult individual.

Grave 19 contained a fused radial head and a fused humerus head, which indicate ages of 13+ years and 15+ years, respectively. From Grave 20, there is the fused distal epiphysis from the humerus (13+ years) and the fused epiphyseal ring on a vertebral fragment (20+ years).

The cranial thickness of fragments from Grave 21 range from 3.5-5 mm; although 3.5 mm is thin for an adult individual, the 5 mm thick fragments are likely indicative of an adult individual.

Remains from Grave 29 contained an adult sized, fused distal end of either metacarpal 2 or 3, providing a minimum age of 14+ years. The cranial fragments range from 3.5 mm to 5 mm, which are most likely from an adult individual. The only bone from which to establish an age for the individual from Grave 29 (2) is a fragment of the scapula which is morphologically developed similar to that of an adult individual.

Grave 86 contained a fragment of an unfused iliac crest, providing an age of under 23 years. There are three fragments from the distal ends of fused metatarsals, a fused distal end of either a metacarpal or metatarsal, and the fused proximal end of a distal hand phalanx from Grave 8-1993. These bone fragments suggest an age of 14+ years. There is one navicular which is adult-like in its morphology and a fragment of a fused glenoid fossa, indicating an age of 17+ years.

The cranial fragments from Grave 9-1993 are 4 mm to 5 mm in thickness, indicating an adult individual. Grave 32-1993 had a fragment of the fused proximal radius (13+ years), the fused distal end of a metacarpal (14+ years), and a mandible fragment with a complete and fully formed 3rd molar socket, which provides an age of 21+ years (Figure 3).

Figure 3. Mandible from Ruše 32.

The majority of the age ranges of the individuals from Ruše were obtained by analyzing degree of fusion on epiphyseal ends and cranial wall thickness. The remaining 10 individuals which could not be aged did not have features present which would have aided in providing an age at death. Only two of the individuals were considered to be juveniles. The individual from Grave 11B was an infant based on the cranial wall thickness and the individual from Grave 86 was under 23 years based on a pelvic fragment with an unfused iliac crest. Five of the individuals (Graves 4, 21, 26, 29 (2), and 1993-9) were only determined to be 'adult' due to the lack of age-related features which would have further defined age at death. The only individual with a defined age range was that from Grave 10, which was aged as a young adult (21-35 years) based on the openness of the cranial suture. Five individuals (Graves 13, 19, 20, 1993-8, and 1993-32) were provided with a minimum age and the remaining three individuals (Graves 16, 18, and 29) were given a 'maximum' minimum age and a determination of 'adult'.

Grave number	Age	Bone	Criteria
1	Adult?	Skull	Cranial thickness
2	16+ years/Adult	Pelvis; skull	Epiphyseal fusion; cranial thickness
3	Adult?	Skull	Cranial thickness
6	Adult	Skull	Cranial thickness
7	Adult	Skull	Cranial thickness
9	Adult	Skull	Cranial thickness
10	12 years/11-14 years	Maxillary 2nd premolar, mandibular 1st premolar; maxillary canine/1st incisor	Erupted, degree of dental development; erupted and fully formed
12	Adult	Skull	Cranial thickness
13	Adult	Skull	Cranial thickness
17	Adult	Skull	Cranial thickness

20	Older adult	Skull	Obliterated cranial suture
21	Adult	Skull	Cranial thickness
23	Adult	Skull	Cranial thickness
24	Adult	Skull	Cranial thickness
26	15+ years/Adult	Maxillary molar	Erupted and fully formed/cranial thickness
27	Adult	Skull	Cranial thickness
28	21+ years	3^{rd} molar	Erupted and fully formed
29	Adult	Skull	Cranial thickness
30	Adult	Skull	Cranial thickness
31(a)	15+ years	Femur	Epiphyseal fusion
31(b)	12-15 years	Maxillary incisor; mandibular 2^{nd} molar	Erupted and fully formed; erupted, degree of dental development
32	Adult?	Skull	Cranial thickness
34	13+ years/Adult	Ulna, radius; skull	Epiphyseal fusion; cranial thickness
34 (2)	14+ years	Phalanx	Epiphyseal fusion
35	11+ years/Adult	Maxillary 2^{nd} incisor; skull	Erupted and fully formed; cranial thickness
36	Adult	Skull	Cranial thickness
38 (b)	9+ years; Adult	Molar root; skull	Erupted and fully formed; cranial thickness
38 (2)	Adult?	Skull	Cranial thickness
42	Adult?	Skull	Cranial thickness
44	Adult	Skull; long bone	Cranial thickness; bone development
47	Adult	Skull	Cranial thickness
50	15-16+ years/Adult	Humerus (or) femur; skull	Epiphyseal fusion; cranial thickness
51	Adult	Skull	Cranial thickness
52	Adult?	Skull	Cranial thickness

Table 7. Brinjeva gora individuals: Indicators of age at death.

Grave number	**Age**	**Bone**	**Criteria**
53	Adult	Skull	Cranial thickness
56	Adult	Skull	Cranial thickness
60	16+ years/Adult	Tibia; skull	Epiphyseal fusion; cranial thickness
62	Adult	Skull	Cranial thickness
63	Adult	Skull	Cranial thickness
65	Adult	Skull	Cranial thickness
68	15+ years	Maxillary 2^{nd} incisor	Erupted and fully formed
68 (2)	17+ years	Scapula	Epiphyseal fusion
70	Adult?	Skull	Cranial thickness
72	Adult?	Skull	Cranial thickness
73	11+ years/Adult	Maxillary 1^{st} incisor; skull	Erupted and fully formed; cranial thickness
77	15+ years	Maxillary canine	Erupted and fully formed

Table 7 cont. Brinjeva gora individuals: Indicators of age at death.

Table 7 indicates the 46 individuals from Brinjeva gora which were assigned an age at death. Grave 1 contained cranial fragments with a thickness of 3.5-4 mm; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Grave 2 had a fragment of the fused olecranon process from the right ulna which provides an age of 13+ years.

Grave 3 contained cranial fragments measuring 4.5 mm in thickness; these fragments are most likely from an adult individual and it is clear they are not from an infant or child. There is a fused iliac crest fragment, suggesting 16+ years. Cranial fragments are approximately 5 mm thick, which is indicative of an adult individual.

Grave 6 contained cranial fragments that are 5 mm thick, despite missing the inner table, indicative of an adult individual.

Grave 7 contained cranial fragments that were 5 mm thick, indicative of an adult.

Grave 9 had cranial fragments ranging in thickness from 4 mm to 7 mm, which is indicative of an adult individual.

Grave 10 contained several bone fragments from which a narrow age range could be established. There is one maxillary 2nd premolar with incomplete roots which indicates an age of between 12 and 15 years of age. There is one incomplete mandibular 1st premolar which provides an age of approximately 11-12 years of age. There is one permanent maxillary canine or incisor with a complete root, indicating an age of 11-15 years. In addition to dental fragments, there is also a fragment of the iliac crest which is unfused (under 23 years) and an unfused middle phalanx (of the hand or foot) which provides an age of less than 21 years. From the dental remains, this was probably a juvenile individual aged between 11 and 15 years.

Graves 12, 13, and 17 contained cranial fragments, ranging in thickness from 5 mm to 7 mm, indicating that the remains are from adult individuals.

Cranial fragments from Grave 20 range in thickness from 5 mm to 7 mm, indicating an adult individual. There is also one fragment with an obliterated suture, which signifies an older adult individual of approximately 50+ years of age.

Grave 26 contained one erupted and fully formed maxillary molar, indicating an age of 15+ years of age. However, the cranial fragments from this grave are approximately 5 mm in thickness, which is indicative of an adult.

From Grave 28, there is the proximal end of a hand phalanx which is fused (14+ years), a complete mandibular 3rd molar (21+ years), and 5 mm to 7 mm thick cranial fragments (adult).

One of the long bone fragments from Grave 31(a) is a piece of the femur, with a fused greater trochanter, which gives an age of 15+ years. However, the cranial fragments from this grave are approximately 5 mm in thickness, which is indicative of an adult individual.

The age of the individual from Grave 31 (b) is 12-15 years. This age range was established based on the presence of an erupted and fully formed maxillary incisor (12+ years) and an incomplete mandibular 2nd molar (under 15 years).

Figure 4. Dental fragments recovered from Brinjeva gora 31(b).

Grave 32 contains cranial fragments with a thickness of 4 mm; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Grave 34 had two long bone fragments, the fused proximal end of the ulna and the fused distal end of the humerus, which provide an age of 13+ years. Based on the thickness of the cranial fragments and the overall robusticity of the bones, this is an adult individual.

Grave 34 (2) had the fused distal end of either a metacarpal or metatarsal and the fused proximal end of a phalanx, both providing an age of 14+ years. There is also either a metacarpal or metatarsal shaft which is adult in size.

Aside from adult-sized vault fragments with a thickness of 4-5 mm, Grave 35 contained a complete permanent maxillary 2nd incisor, providing an age of 11+ years.

Grave 36 contained skull fragments with a cranial thickness of 4-5 mm, which is indicative of an adult individual.

Aside from morphologically adult cranial fragments, the only fragment from which to determine age at death for Grave 38 (b) is a tooth – an erupted and fully formed molar root (specific tooth unknown) which provides an age of 9+ years.

The individual from Grave 38 (2) contained skull fragments with cranial thickness of 4 mm. This is probably an adult individual and is definitely not an infant based on the size of the cranial fragments.

Grave 42 contained two cranial fragments, one 3 mm in thickness, the other 5 mm in thickness. These fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Based on cranial thickness and overall long bone robusticity, the individual from Grave 44 was an adult.

Grave 50 had a long bone fragment which is either the head of the humerus or femur; this fragment provides an age of 15+ years of age. Cranial fragments from this grave indicate an adult individual.

Grave 51 contained a cranial fragment with a moderately closed suture, indicating an older adult individual; the thickness of the cranial fragments is also indicative of an adult individual.

Grave 52 contained skull fragments with cranial thickness of 3.5 mm to 4.5 mm. These fragments are probably from an adult individual; it is clear they are not from an infant or child.

Grave 60 had the fused distal end of a tibia, indicating 16+ years of age; additionally, cranial fragments from this grave are 5-6 mm thick, indicative of an adult individual.

Grave 62 had cranial fragments measuring 5-8 mm in thickness, indicative of an adult individual.

Grave 65 has been determined to be an adult individual based on cranial fragments measuring 4-5 mm thick.

From Grave 68, there were three fragments from which to determine an age at death. There was a complete permanent maxillary 1st molar which finishes developing at 9+ years of age. There was a permanent mandibular 1st premolar which is complete at 12+ years. There was also a fragment of a fused glenoid fossa, providing the highest minimum age of 17+ years.

Grave 68 (2) had a maxilla fragment with completely developed tooth sockets from the right 2nd incisor and right canine; the complete development of these sockets occurs at 15+ years of age.

Graves 70 and 72 had cranial fragments measuring 3-4 mm; this most likely indicates an adult individual and is clearly not an infant.

Aside from cranial thickness, the only fragment from which to establish an age at death for Grave 73 is a fully developed permanent maxillary 1st incisor, which is complete at 11+ years.

Grave 77 had four tooth fragments from which to establish age. One is a permanent mandibular 1st molar which is complete at 8+ years. The other three fragments, a permanent maxillary canine, an erupted and fully formed maxillary 1st premolar, and a complete maxillary 2nd premolar, provide an age of 15+ years. There is also a completely developed adult mandibular 1st premolar from the red matchbox which accompanied the other cremated remains from Grave 77.

Graves 21, 23, 24, 27, 29, 30, 47, 53, 56, and 63 all have cranial fragments over 5 mm thick, which indicates adult individuals.

Out of the 66 total individuals from Brinjeva gora, 20 individuals could not be aged as they did not have features present which would have provided an age at death. There were two individuals (Graves 10 and 31B) which could be assigned a narrow age range. Grave 10 contained an individual aged 11-14 years based on the incomplete development of a maxillary 2nd premolar and a mandibular 1st premolar and the complete development of a maxillary canine and maxillary 1st incisor. Grave 31B contained the remains of a 12-15 year old individual. This age range was determined based on a fully developed maxillary incisor and a mandibular 2nd molar which had erupted but was not complete. One individual (Grave 20) was determined to be an 'older adult' based on cranial suture closure. Six individuals (Graves 28, 31A, 34(2), 68, 68(2), and 77) were assigned a minimum age, seven individuals were queried to be adult (Graves 1, 3, 32, 38(2), 42, 52, 70, and 72) and 21 individuals (Graves 6, 7, 9, 12, 13, 17, 21, 23, 24, 27, 29, 30, 36, 44, 47, 51, 53, 56, 62, 63, and 65) were given a general age determination of 'adult'. The remaining 8 individuals (Graves 2, 26, 34, 35, 38B, 50, 60, 73) were assigned a maximum minimum age and a description of 'adult'. Epiphyseal fusion and cranial wall thickness were the main methods utilized when attempting to determine age at death for the individuals from Brinjeva gora.

Grave number	Age	Bone	Criteria
1	Adult?	Skull	Cranial thickness
3	Adult	Skull	Cranial thickness
14	16+ years	Pelvis	Epiphyseal fusion
26	20+ years	Vertebra	Epiphyseal fusion
27	21-30 years	Pelvis	Auricular surface
32	14+ years	Metatarsal	Epiphyseal fusion
36	15+ years/Adult	Radius, ulna; skull	Epiphyseal fusion; cranial thickness
39	Adult?	Skull	Cranial thickness
55	13+ years	Radius	Epiphyseal fusion
56	Adult	Skull	Cranial thickness
57	15+ years/Adult	Femur; skull	Epiphyseal fusion; cranial thickness

59	15+ years	Humerus	Epiphyseal fusion
63	Adult	Humerus, femur	Bone development
63 (2)	Adult?	Skull	Cranial thickness
68	20+ years	Vertebra	Epiphyseal fusion
70	Infant	Skull	Cranial thickness
72	15+ years	Ulna	Epiphyseal fusion
73	14+ years/Adult	Metatarsal; skull	Epiphyseal fusion; cranial thickness
75	Adult	Skull	Cranial thickness
76	Infant	Skull	Cranial thickness
78	Adult	Pelvis	Bone development
79	Adult	Pelvis; long bone	Bone development
81-75d	21-30 years	Pelvis	Auricular surface
84	16+ years	Humerus	Epiphyseal fusion
85	13+ years	Ulna, humerus	Epiphyseal fusion
86	20+ years	Vertebra	Fused vertebral body
87	Adult	Skull	Cranial thickness
91	14+ years/Adult	Metacarpal; skull	Epiphyseal fusion; cranial thickness
94	16+ years/Adult	Pelvis; skull	Epiphyseal fusion; cranial thickness
96	14+ years	Metacarpal/tarsal	Epiphyseal fusion
97	20+ years	Vertebra	Epiphyseal fusion

Table 8. Pobrežje individuals: Indicators of age at death

Grave number	Age	Bone	Criteria
97 (2)	Adult	Vertebra	Bone development
98	13+ years/Adult	Humerus; skull	Epiphyseal fusion; cranial thickness
101	16+ years	Fibula, femur	Epiphyseal fusion
106	16+ years	Femur	Epiphyseal fusion
107	14+ years	Metacarpal	Epiphyseal fusion
108	Adult	Skull	Cranial thickness
109	Adult	Skull	Cranial suture closure
111	13+ years	Humerus	Epiphyseal fusion
112	15+ years/young adult	Maxillary incisors, canine, premolar; skull	Tooth socket completion; cranial suture closure
113	16+ years	Humerus	Epiphyseal fusion
117(2)	Infant	Skull	Cranial thickness
120	Adult?	Skull	Cranial thickness
122	Old adult	Skull	Obliterated cranial suture
134	16+ years/Adult	Humerus; skull	Epiphyseal fusion; cranial thickness
135	16-20 years	Pelvis; 3rd molar	Epiphyseal fusion; erupted, degree of dental development
137	20+ years	Vertebra	Epiphyseal fusion
137 (2)	14+ years	Phalanx	Epiphyseal fusion
138	Infant	Skull	Cranial thickness
139	Adult	Skull	Cranial thickness
141	14+ years	Metacarpal	Epiphyseal fusion
144	Adult?	Skull	Cranial thickness
147	13+ years/Adult	Ulna; skull	Epiphyseal fusion; cranial thickness
148	13+ years/Adult	Radius; skull	Epiphyseal fusion; cranial thickness
153	Adult	Skull	Cranial thickness

156	17+ years	Scapula	Epiphyseal fusion
164	15+ years	Ulna	Epiphyseal fusion
171	11+ years/Adult	Maxillary incisors; pelvis, long bone	Tooth socket completion; bone development
173	15-16+ years	Humerus (or) femur	Epiphyseal fusion
175	Adult?	Skull	Cranial thickness
177	Adult?	Skull	Cranial thickness
226	16+ years/Adult	Humerus; skull	Epiphyseal fusion; cranial thickness

Table 8 cont. Pobrežje individuals: Indicators of age at death.

Table 8 shows the individuals from Pobrežje which were assigned an age at death. Grave 1 had cranial fragments ranging from 3.5 mm to 5 mm; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Grave 3 contained cranial fragments with a thickness of 5 mm, which indicates an adult individual.

From Grave 14, there was a fused proximal end of a distal phalanx, providing an age of 14+ years. There was also a fragment of the fused iliac crest, indicating that the individual was at least 16 years of age at death.

Grave 26 contained the fused distal end of a radius, which gives an age of 15+ years and a vertebral fragment with a fused epiphyseal ring, indicating 20+ years of age.

Grave 27 contained one permanent maxillary 1st premolar, suggesting an age of 15+ years. Cranial fragments from this grave are 5-6 mm thick, indicating an adult individual. On one of the pelvic fragments, the auricular surface is present; it is smooth with a fine granular texture, typical of an individual in the age range of 21-30 years of age.

Grave 32 included two long bone fragments, the proximal end of the radius and the distal end of the humerus, which are fused and provide an age of 13+ years. There is also the distal end of a metatarsal which is fused, indicating an age of 14+ years.

There are several bone fragments from which to establish an age at death from Grave 36. There is a fragment of the mandible with the mandibular spines and the completely formed sockets of the four mandibular incisors, which provides an age of

12+ years. There is a fused distal end of a humerus indicating 13+ years and the distal end of a metacarpal or metatarsal and the distal end of the 2nd metatarsal which is fused, giving an age of 14+ years. Both the fused distal ends of an ulna and radius are present, providing an age of 15+ years and judging from the thickness of the cranial fragments, this is an adult individual.

The cranial fragments from Grave 39 measure 3-4 mm thick; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Grave 55 produced one bone from which age at death could be determined; this is a fused radial head, indicating an age of 13+ years.

From Grave 57, there are two long bone fragments from which to determine age. There is a fused proximal end of a proximal hand phalanx, indicating an age of 14+ years and a fused femoral head, indicating 15+ years of age. Cranial fragments are indicative of an adult individual.

The fused distal end of the humerus was present in Grave 59, providing an age of 15+ years.

The individual from Grave 63 was determined to be an adult individual, based on the robusticity of the humerus shaft fragment and the size of the femoral head fragment.

Grave 63 (2) contains cranial fragments 3-4 mm in thickness; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Grave 68 contained one fragment of the maxilla with a single root socket from an incisor. This suggests an age of 11+ years. There is a fragment of the fused proximal end of an ulna (13+ years). There is one small fragment of a fused glenoid fossa suggesting an age of 17+ years and a vertebral fragment with a fused epiphyseal ring, indicating an age of 20+ years.

The cranial bones from Graves 70 and 76 were extremely thin, with an average thickness of 1.5 mm, and many less than 1 mm. From the friability and thickness of the cranial bones, the individual is likely to be an infant, however as no other bones are available from this grave from which to determine age, the age of this child could not be established more precisely.

Grave 72 has two long bone fragments, the fused distal end of a humerus and the fused distal end of an ulna, which provide ages of 13+ years and 15+ years, respectively.

The age of the individual from Grave 73 was established from the fused distal end of a metatarsal and the thickness of the cranial vault. The metatarsal places the individual at 14+ years.

The individuals from Grave 78 and 79 were determined to be adults based on the morphology of the acetabulum fragments and the size of the long bone shaft fragments.

From Grave 81-75d, there was an ilium fragment with a smooth and fine-grained auricular surface which is characteristic of an individual between 21 and 30 years of age. There was also a vertebral fragment with a fused epiphyseal ring, indicating an age of 20+ years.

Grave 84 contained the fused proximal end of an ulna, consistent with an age of 13+ years. There was the fused distal end of either a metacarpal or metatarsal, indicating an age of 14+ years and a fused humerus head providing an age of 16+ years.

There were two long bone fragments from Grave 85 which indicate an age of 13+ years; these bones are the fused proximal end of the ulna and the fused distal end of the humerus.

Grave 86 had several bone fragments from which age at death could be determined. There is a fused distal end of a humerus (13+ years), a fused distal end of a metacarpal (14+ years), a fused distal end of a radius (15+ years), a fragment of a fused glenoid fossa (17+ years), and a vertebral fragment with a fused epiphyseal ring (20+ years).

The individual from Grave 91 was interpreted as an adult based on cranial thickness and the size and morphology of the metacarpals.

Grave 94 had the fused distal end of a humerus which provides a minimum age of 15+ years. There was also a fragment of the fused iliac crest, indicating 16+ years, and a vertebral fragment with a fused epiphyseal ring, providing an age of 20+ years. The average cranial thickness of 5 mm also indicates an adult.

The only bone from Grave 96 from which age at death could be determined is the fused distal end of either a metacarpal or metatarsal, which suggests an age of 14+ years.

Grave 97 had the fused proximal end of a proximal hand phalanx indicating an age of 14+ years, and a fused epiphyseal ring fragment indicating 20+ years of age.

Grave 97 (2) contained the centrum of a lumbar vertebra; although there is no epiphyseal ring present due to damage, the individual is interpreted as an adult based on the size and development of the fragment.

There is one fused distal end of the humerus from Grave 98, providing an age of 13+ years. This individual is also considered an adult based on the thickness of the cranial vault fragments.

Several bone fragments from Grave 101 have features from which age at death could be estimated. There is a fused distal and proximal end of a humerus, which provides ages of 13+ years and 15+ years, respectively. The fused distal end of the fibula and the fused distal end of the femur both suggest an age of 16+ years for this individual.

There are two fragments from Grave 106 from which the age at death could be determined. There is a fused proximal phalanx indicating 14+ years and a fragment of the fused distal femur indicating 16+ years. Both the left and right naviculars are also present which are morphologically developed like an adult.

The only bone from Grave 107 from which to determine age was the distal end of a fused 2nd metacarpal, which fuses at 14+ years of age.

From Grave 109, there is one fragment with a cranial suture which is moderately closed, typical of an adult individual.

Grave 111 contained the right and left fused radial heads and the fused distal end of a humerus; all three of these bone fragments indicate an age of 13+ years.

From Grave 112, there is a maxilla fragment with four complete tooth sockets from the right side; these are the 1st and 2nd incisors, the canine, and the 1st premolar which all give an age of 15+ years. There is also one vault fragment with an open cranial suture, characteristic of a young adult individual.

Grave 113 had three bone fragments from which to determine age. These are the fused proximal end of the ulna, the fused distal end of a metatarsal, and the fused proximal end of a humerus which provide ages of 13+ years, 14+ years, and 16+ years, respectively.

The individual from Grave 117 (2) was determined to be either a neonate or an infant, owing to the extremely thin nature of the bones; however a more precise age cannot be determined owing to the absence of other age-related features.

Grave 120 contained cranial fragments with a thickness of 4 mm; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Grave 122 had cranial fragments with obliterated cranial sutures, providing an age of 'old adult.'

Grave 134 had several bone fragments from which to determine age. There are three fused distal ends of metatarsals which provide an age of 14+ years. There is also the fused distal end of the radius and the fused proximal end of the femur, indicating an age of 15+ years and a fused humerus head which fuses at 16+ years. This individual has also been determined to be an adult judging from the thickness of the cranial vault fragments.

From Grave 135, there were two distal foot phalanges and the fused distal head of a metatarsal which are fused, indicating an age of 14+ years. There is one erupted and fully formed permanent mandibular 2nd premolar which is complete at 15 years of age. There is a fragment of the fused iliac crest, indicating an age of 16+ years. There is one incomplete permanent mandibular 3rd molar, which means that the individual is younger than 21 years of age. There is also an adult-sized scaphoid, which becomes morphologically adult between 12 and 15 years of age, depending on the sex of the individual. Based on these age-related features, this individual can be placed at 16-20 years of age.

From Grave 137, there is the distal end of a humerus which fuses at 13+ years and a fragment of a fused distal radius which fuses at 15+ years. The fused left humerus head is present, which fuses at 16+ years and one vertebral fragment with a fused epiphyseal ring, providing a minimum age of 20+ years.

Grave 137 (2) has the fused proximal end of a proximal phalanx (hand or foot unknown), indicating an age of 14+ years.

The individual from Grave 138 was determined to be a neonate. The cranial bones have an average thickness of 1 mm, and most of the bone fragments cannot be picked up owing to immediate breakage; however, there are no other bone fragments from which a more accurate determination of age could be ascertained.

From Grave 141, there is one fused metacarpal, indicating an age of 14+ years. There are several bone fragments, especially long bones, with unfused epiphyses; such unfused areas would indicate a juvenile individual. However, none of the bone fragments could be assigned to a specific skeletal feature, which would permit a better estimation of age. It is assumed that this individual was slightly over 14 years of age at the time of death.

Grave 144 contained cranial fragments with a thickness of 4 mm; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Aside from cranial thickness, the only bone from Grave 147 from which to estimate age at death was a fragment of the fused proximal end of an ulna, which fuses at 13+ years.

Like Grave 147, Grave 148 had only the fused proximal end of a radius (13+ years) and morphologically adult cranial fragments from which age could be determined. Grave 153 contains cranial fragments with a thickness of 4 mm; these fragments are most likely from an adult individual and it is clear they are not from an infant or child.

Grave 156 contained the fused proximal end of a medial hand phalanx. This bone provides an age of 14+ years. There is also a fragment of a fused distal radius and a fused glenoid fossa fragment, providing ages of 15+ years and 17+ years, respectively.

The only bone fragment from which to establish an age at death for the individual from Grave 164 is a fragment of a fused distal ulna, indicating 15+ years of age at death.

Grave 171 contains a fragment of the maxilla with three completely formed incisor sockets. These sockets are fully formed at 11+ years. Although the thickness of the cranial bone fragments is smaller than average for an adult individual, the other remains are morphologically adult in size and shape.

From Grave 173, there is the fused proximal end of a proximal hand phalanx which fuses at 14+ years of age. There is one fragment of the distal end of an ulna, which fuses at 15+ years. There is also one fragment that is either from a fused humerus or femur head. This fragment provides an age of 15+ years.

Grave 175 contained cranial fragments with a thickness of 4-4.5 mm; these fragments are probably from an adult individual and it is clear they are not from an infant or child.

Grave 177 contained cranial fragments ranging from 3-5 mm; it is likely that these fragments belong to an adult individual and are clearly not from an infant.

Grave 226 contained several bone fragments from which the age at death could be determined. There is a fused distal end of a humerus and the fused proximal end of a radius, both of which fuse at 13+ years. There is a fused distal end of either metacarpal 3 or 4, a fused 1st distal phalanx of the foot, a fused medial phalanx, and a fused proximal end of a proximal phalanx. These bone fragments indicate an age of 14+ years. There is a fused head of a femur and a fused distal end of an ulna, which provide an age of 15+ years. A fused humerus head is also present which fuses at 16+ years of age, is also present. Cranial fragments from this individual are approximately 6 mm in thickness, indicating an adult individual.

Remains from Graves 56, 75, 87, 108, and 139 were determined to be from adult individuals, judging by the thickness of the cranial vault fragments

There were 15 out of 77 individuals from Pobrežje which could not be assigned an age determination due to the absence of age-related features. There were four individuals (Graves 70, 76, 117(2), and 138) that were categorized as being infants based on the size and thickness of the cranial vault fragments. There were two individuals (Graves 27 and 81-75d) aged between 21 and 30 years based on the development and condition of the auricular surface. The individual from Grave 122 was categorized as "older adult" based on an obliterated cranial suture. There was one individual (Grave 135) which was aged between 16-20 years based on the fused iliac crest of the pelvis and the incomplete development of the 3rd permanent mandibular molar. There are seven queried adults (Graves 1, 39, 63(2), 120, 144, 175, and 177), 12 'adult' individuals (Graves 3, 56, 63, 75, 78, 79, 87, 97(2), 108, 109, 139, 153) and 23 individuals (Graves 14, 26, 32, 55, 59, 68, 72, 84, 85, 86, 96, 97, 101, 106, 107, 111, 113, 137, 137(2), 141, 156, 164, and 173) assigned a minimum age. The remaining 12 individuals (Graves 36, 57, 73, 91, 94, 98, 112, 134, 147, 148, 171, and 226) were assigned a maximum minimum age and a description of 'adult'. Cranial thickness and epiphyseal fusion were the main methods used to determine age at death. The specific age of the infants was not obtainable due to the lack of other age-related features.

In total, there were 124 out of 169 individuals which were assigned an estimation of age. From all three sites combined, there were five infants, 1 individual between 11-14 years, 1 individual between 12-15 years, 1 individual between 16-20 years two individuals between 21-30 years, 1 individual under 23 years, 1 'young adult', 2 'older adults', 38 'adults', 15 queried "adults", 34 individuals assigned a minimum age, and 23 individuals assigned with a maximum minimum age and a determination of adult.

5.3 Sex Determination

Table 9 shows the individuals from all three sites which were assigned a determination of sex. From the 169 individuals, there were only eight individuals for which the sex could be determined. The remaining 161 individuals could not be sexed due to the absence of fragments with sexually dimorphic features which would have aided in establishing an estimation of sex.

Site	Grave Number	Sex	Bone	Criteria
Ruše 1952	10	Male?	Skull	Browridge, supraorbital margin
Ruše 1952	21	Female?	Skull	Supraorbital margin
Ruše 1993	32	Female	Radius	Radial head measurement
Brinjeva gora	53	Female?	Pelvis	Sciatic notch
Pobrežje	27	Female	Pelvis	Preauricular sulcus
Pobrežje	36	Male?	Skull	Browridge, supraorbital margin
Pobrežje	81-75d	Male?	Pelvis	No preauricular sulcus
Pobrežje	94	Male?	Skull	External occipital protuberance

Table 9. Individuals with assigned sex identification.

As shown in the above table, the eight skeletons from the three sites under study for which the sex could be determined comprise four males and four females. For Ruše 1952-10, there is a section of the right zygomatic arch and a section of the orbital bone with a rounded superior margin and protruding browridge; these sexually dimorphic features tend to be characteristic of male individuals. One of the orbital fragments from Ruše 1952-21 is from the left side of the calavaria with a sharp superior margin while the other fragment is from the right side, is more robust, and has a slightly less sharp superior margin. While the presence of two orbital sections of slightly varying shape and robusticity may indicate two individuals, it is likely that these fragments are from the same individual, and most likely female individual due to the sharp superior margin. There is one radial head from Ruše 1993-32 which measures 22 mm in diameter (Figure 5). This measurement falls within the range which is typical for female individuals.

Figure 5. Radial head from Ruše 1993-32.

Only one individual from Gračič had any sexually diagnostic features from which sex could be determined. Gračič-53 has one pelvic fragment which is a part of the greater sciatic notch. It appears to be wide in morphology, indicating a female individual; however a portion of the fragment is broken and missing so this conclusion cannot be made with complete accuracy.

Pobrežje-27 has been determined as female from the presence of a fragment of the ilium with the preauricular sulcus. The presence of this sexually dimorphic feature, along with its deep and narrow morphology, is characteristic of a female individual. Pobrežje-36 contained a fragment of the frontal bone with a large browridge and a rounded supraorbital margin, which are typically male characteristics. Pobrežje 81-75d has one fragment of the ilium with the preauricular sulcus absent. Owing to the fact that males tend to lack the preauricular sulcus, this individual is most probably a male. The individual from Pobrežje-94 is interpreted as male, based on the presence of an occipital fragment exhibiting a very large and robust external occipital protuberance.

For the majority of the individuals, the sex determination was assumed on the basis of the fragments present, but this determination cannot be considered completely accurate due to the lack of other sexually dimorphic features which would have helped in further confirming the determination of sex.

5.4 Pathologies

Out of the 169 cremations analyzed, only nine individuals from all three sites exhibited any sign of pathological abnormalities. No healed fractures were identified on any of the bones. The two pathologies discovered were cases of spinal degeneration and porotic hyperostosis, as evidenced by slight osteophytic growth on the margins of the vertebral centrums and cranial pitting.

Site	Grave number	Pathology	Criteria
Ruše 1952	20	Spinal degeneration	Vertebral lipping
Brinjeva gora	20	Porotic hyperostosis	Cranial pitting with lamellar bone growth
Brinjeva gora	28	Porotic hyperostosis	Cranial pitting with lamellar bone growth
Pobrežje	26	Spinal degeneration	Vertebral lipping
Pobrežje	39	Porotic hyperostosis	Cranial pitting
Pobrežje	84	Porotic hyperostosis	Cranial pitting
Pobrežje	87	Porotic hyperostosis	Cranial pitting with lamellar bone growth
Pobrežje	94	Porotic hyperostosis	Cranial pitting
Pobrežje	101	Porotic hyperostosis	Variable diploë thickness across vault

Table 10. Individuals exhibiting pathological lesions.

Table 10 indicates the individuals with assigned pathologies. There are two individuals exhibiting signs of spinal degeneration. Grave 20 from Ruše contains a vertebral centrum with slight proliferative osteophytic bone growth and from Grave 26 at Pobrežje, there is the centrum of a lumbar vertebra is present with slight osteophytic formation on the margin of the body. Neither porosity nor contour change could be assessed as evidence for spinal degeneration from these bone fragments, as both were altered and damaged due to firing. Both of these individuals were determined to be over 20+ years of age, as evidenced by fused epiphyseal rings on vertebral fragments. This the only age range that could be determined based on the bone fragments present, so it is not possible to attribute the presence of spinal degeneration necessarily to old age.

The remaining seven individuals with pathological lesions are those with signs of porotic hyperostosis as evidenced by cranial pitting and varying diploë thickness. Cranial fragments from Graves 20 and 28 at Brinjeva gora and Grave 87 at Pobrežje exhibit pitting with sclerotic bone growth. The nature of the bone growth in association with the cranial lesions suggests a period of healing. Graves 26, 39, and 94 from Pobrežje exhibit cranial pitting without visible lamellar bone growth; this indicates that the lesions may have been active at the time of death. Grave 101 from Pobrežje contains cranial vault fragments which have variable diploë thickness.

It is possible that the cranial pitting exhibited may be attributed to other pathologies than porotic hyperostosis. With porotic hyperostosis, both cranial pitting and thickening of the diploë must be present in order to make an accurate diagnosis. While there were cranial fragments with either cranial pitting or variable diploë thickness, there were not any fragments which exhibited both simultaneously.

Figure 6. Cranial fragment exhibiting pitting.

5.5 Temperature of Firing

As mentioned previously in Chapter 2, the change in color of the bone reflects the ongoing chemical processes associated with the various stages of cremation and the approximate temperature at which the individual was cremated (Mayne Correia, 1997: 276). The change in color also indicates the increasing combustion of the organic component (McCutcheon, 1992: 365). The overall color of the bones from each assemblage was recorded in addition to the specific colors of the bones from each skeletal element. For the following tables, the principal color/s from each bone assemblage and the associated temperature of firing is shown. The color variations and the basis for such difference in color will be discussed below.

Grave Number	Overall bone color	Temperature of Firing
3	Tan	200-300°C
4	Dark tan	200-300°C
9	Tan	200-300°C
10	Brown, white	200-645°C
11	Tan	200-300°C
11B	White	>645°C
13	Black, brown, blue	200-500°C
13B	Tan, grey	200-300°C
14	Dark brown, black, white	200-645°C
14B	White	>645°C
16	Tan, black, blue	200-500°C
18	Dark brown	200-300°C
19	Brown	200-300°C
19(2)	Tan, dark blue, white	200-645°C
20	Brown, grey	200-300°C
21	Brown	200-300°C
23	Brown, grey, white	200-645°C
26	Brown, grey	200-300°C
29	Brown	200-300°C
29B	Tan, white	200-645°C
29(2)	Black, white	500-645°C
34	Tan	200-300°C

Table 11. Ruše: Temperature of Firing.

Grave Number	Overall bone color	Temperature of Firing
86	Tan	200-300°C
1993-8	Light brown, grey, white	200-645°C
1993-9	Tan	200-300°C
1993-32	Tan	200-645°C

Table 11 cont. Ruše: Temperature of Firing.

Table 11 shows the coloration and temperature of firing of the remains from the 26 individuals from Ruše. Of the 26 Ruše cremations, seven (Graves 3, 4, 9, 11, 19, 21, 29 34, 86, 1993-9) are completely tan or brown in color, indicative of low burning at 200-300°C.

Figure 7. Right and left petrous bones from Pobrežje 70.

Several Ruše cremations exhibit other stages of burning aside from the solid tan/light brown hue of low burning. Although mainly brown, Grave 10 has one rib fragment that is white and calcined, that fragment having been burned at a higher temperature and possibly left on the pyre for longer than the rest of the cremation. The bones from Grave 11B are white in color. This cremation includes the remains of an infant, which may have been exposed to heat for a prolonged period of time in order to achieve this state of calcination. Graves 13 and 16 contained bone fragments that are dark brown in color, with areas of black and dark blue. The temperature of this cremation exceeded 300°C and the bones were left on the pyre for slightly longer, as evidenced by the bones beginning to acquire black and blue colorations. The bones from Graves 13B, 20, 23, and 26 are mainly brown with grey edges, indicating that the bones were exposed to temperatures approaching 300°C for slightly longer than the majority of the cremations. Several fragments from Grave 23 are also white in color, suggesting that an area of the cremation was exposed to higher temperatures.

The majority of bones from Graves 9, 18 and 86 are tan in color; however, on several fragments from each cremation there are areas with a white coloration that is not due to high temperatures. The white color occurs sporadically on the bones and may be due to soil staining. The bones of Grave 14 are mainly dark brown in color; however the cranial bones are white on the external side and beige on the internal side. This may be due to prolonged exposure to temperatures of over 645°C, but only on the external side. This suggests that the internal side of the cranial vault was shielded from the fire, due to the signs of low temperatures and/or limited exposure to heat. Grave 14B has only 14 bone fragments, all of which are calcined, indicating exposure to temperatures of over 645°C.

The bones from Graves 19(2), 29B and 32-1993 were burned at different temperatures for varying periods of time, as the bones range in color from tan with edges of blue, and white. The sporadic burning of Grave 19(2) is similar to that of Grave 8-1993, which ranges in color from light brown and tan to light grey and white; this suggests uneven burning of the individual. Grave 29(2) has bones which are mainly black and white, indicating temperatures of above 500°C and in places, over 645°C as evidenced by calcination.

While many of the assemblages were homogeneous in color, several of the assemblages had fragments which ranged in color from tan and light brown to black and blue to the bright white of calcination. The majority of the remains from Ruše were lightly burned at temperatures of 200-300°C as evidenced by the tan and light brown color. It is clear that several of the remains from Ruše did reach over 645°C, shown by the calcined bone fragments. For 14 out of 26 individuals, the primary temperature of firing was 200-300°C with two individuals ranging from 200-500°C. There were two individuals completely calcined at over 645°C, seven individuals ranging from 200-645°C, and one individual from 500-645°C.

Grave Number	Color	Temperature of Firing
1	Black, blue, white	500-645°C
2	Tan, grey	200-500°C
3	Tan, black, grey	200-500°C
6	Dark brown, black,	200-645°C

	grey, white	
7	Blue, grey	500-645°C
9	Tan, grey	200-500°C
10	Tan, grey, white	200-645°C
12	Brown, grey	200-500°C
13	Dark brown, white	200-645°C
14	Tan, dark grey, blue, white	200-645°C
15	Tan	200-300°C
15B	Dark brown, blue, white	200-645°C
17	Tan, blue-grey	200-645°C
19	Tan, black, grey, white	200-645°C
20	Tan	200-300°C
21	Tan, blue	200-645°C
22	Tan, dark grey, white	200-645°C
23	Dark brown, black, white	200-645°C
24	Tan, brown, black	200-500°C
25	Tan, grey	200-500°C
26	Dark brown, black	200-500°C
27	Dark brown, black, tan	200-500°C
28	Dark brown, black	200-500°C
29	Dark brown, black, white	200-645°C
30	Brown, white	200-645°C
31a	Dark brown, white	200-645°C
31b	Dark blue, white	500-645°C
32	Grey, white	500-645°C
33	Black, blue, white	500-645°C
34	Brown, grey	200-500°C
34(2)	Brown, grey	200-500°C
35	Brown, grey, white	200-645°C

Table 12. Brinjeva gora: Temperature of Firing.

Grave Number	Color	Temperature of Firing
35(2)	White, grey	500-645°C
36	Dark brown, white	200-645°C
37	Dark brown	200-300°C
38(2)	Dark brown, white	200-645°C
38b	Brown, blue, white	200-645°C
39	Grey, blue, white	500-645°C
39b	Tan, grey	200-500°C
40	Tan, grey	200-500°C
42	Tan, grey	200-500°C
43	Tan, grey, blue	200-500°C

44	Dark brown, black, blue	200-645°C
45	Tan, grey, white	200-645°C
47	Brown, black, grey, white	200-645°C
49	Blue, white	500-645°C
50	Blue, white	500-645°C
51	Dark brown, black	200-500°C
52	Tan, black, grey	200-500°C
53	Blue, grey	500-645°C
56	Black, white	500-645°C
57	Tan, blue	200-645°C
58	Brown	200-300°C
59	Brown, blue	200-500°C
60	Tan, blue, grey	200-645°C
61	Tan, grey, white	200-645°C
62	White, grey	500-645°C
63	White, black	500-645°C
65	White, grey	500-645°C
68	Black, grey, white	200-645°C
68(2)	Tan, grey	200-500°C
70	Tan, blue, white	200-645°C
70(2)	Tan, grey, white	200-645°C
72	Grey, white	500-645°C
73	Tan, grey	200-500°C
77	White	>645°C

Table 12 cont. Brinjeva gora: Temperature of Firing.

As shown in Table 12, most of the bones from Brinjeva gora are dark brown and black with grey edges, suggesting burning to higher temperatures than at Ruše.

Figure 8. Proximal end of hand phalanx showing differential burning.

Graves 1, 31(b), 33, 39, 49, 50, and 56 exhibit mainly dark blue and blackened bones with slight calcination and light grey coloring appearing on the edges and in places along the external cortical surfaces. This type of burning is typical of bones burned between 500-645°C. The bones from Graves 13, 15B, 19, 23, 29, 30, 31(a), 36, and 38(2) exhibit progression with temperatures gradually increasing from around 200-300°C up to 500-645°C as shown by mainly dark brown and black bones from low temperature exposure and dark and light grey and white bones due to high temperatures.

Bone fragments from graves 2, 3, 9, 12, 24, 25, 26, 27, 28, 34, 34(2), 39(b), 40, 42, 43, 51, 52, are mainly tan, brown, black, and grey in color; this shows exposure to mainly low to moderate temperatures around 200-300°C and reaching 500°C in places. The bones from Graves 7 and 53 are mainly dark blue in color, suggesting an estimated temperature range of 500°C-645°C; however, there are small areas of tan and grey indicating a lower temperature range and areas of white due to exposure to temperatures over 645°C.

The bones from Graves 10, 14, and 70(2) are mainly tan in color; however many of the long bone fragments are black, dark blue, and white in color and just starting to reach complete calcination. Bones from Graves 6, 17, 22, 44, 47, 57, 60, 61, and 68 are tan in color with the edges just starting to turn blue, black, and grey white along the edges; this type of burning is indicative of low to medium burning, with exposure to slightly higher temperatures around the edges. Bones from Grave 21 are light blue and light grey in color, with the smaller fragments being tan in color. It appears that temperatures were moderate, with lower heat in certain areas.

Long bone fragments from Grave 35 range in color from tan, black, blue, and white; although the cranial fragments are white due to calcination and exposure to constant high temperatures over 645°C. Bones from Graves 15, 20, 37 and 58 are dark brown in color, indicating low burning around 200-300°C. Bones from 38(b) are dark blue and dark brown with slight grey and white edges. Long bone fragments from Grave 45 are light grey and white with black edges due to a state of near calcination with the other bones being tan and light grey in color. Grave 59 and 73 have light brown, dark brown, grey and blue. The bones from Grave 68(2) are predominately light grey and tan, those from Grave 70 are light grey, tan, with a few showing signs of with calcination, and those from Grave 77 are mainly calcined with a few light grey bones. Graves 32, 35(2) 62, 63, 65, and 72 contained bones that are calcined white and blue-grey in color. This coloration is typical of burning between 500-645°C (Mays, 1998: 217).

Figure 9. Long bone fragment showing black coloration.

In total from Brinjeva gora, there are four individuals within the 200-300°C range, 20 individuals within the 200-500°C range, 26 individuals within 200-645°C, 15 within 500-645°C, and only one individual at over 645°C. While most of the bones were burned at lower temperatures, many of the assemblages exhibit coloring typical of burning over 500°C, up to and exceeding 645°C.

Figure 10. Cranial fragments exhibiting blackened and white colorations.

Grave Number	Color	Temperature of Firing
1	Brown	200-300°C
3	Brown, grey	200-500°C
14	Brown, grey	200-500°C
19	Grey, white	500-645°C
26	Tan	200-300°C
27	Grey, blue, white	500->645°C
32	Tan, grey	200-500°C
36	Tan, grey	200-500°C
39	Tan	200-300°C
55	Tan	200-300°C
56	Tan	200-300°C
57	Tan, blue, white	200-645°C
59	Tan	200-300°C
61	Tan	200-300°C
63	Brown, dark grey	200-500°C
63(2)	Tan, white, grey	200-645°C
66	Tan, white	200-645°C
68	Tan, black, white	200-645°C
70	Tan, grey, white	200-645°C

Table 13. Pobrežje: Temperature of Firing.

Grave Number	Color	Temperature of Firing
72	Tan	200-300°C
73	Tan, grey, white	200-645°C
75	Tan, grey, white	200-645°C
76	White	>645°C
78	Tan, grey, blue	200-645°C
79	Tan	200-300°C
80	Tan, grey	200-500°C
81-75d	Tan, grey, white	200-645°C
83	Tan, white	200-645°C
84	Tan, grey	200-500°C
85	Brown	200-300°C
86	Tan, grey	200-500°C
87	Tan	200-300°C
91	Tan, grey	200-500°C
94	Brown, grey, blue	200-645°C
96	Brown, grey,	200-645°C

	white	
96*	Brown, grey	200-500°C
97	Tan	200-300°C
97*	Brown	200-300°C
98	Brown	200-300°C
100	Tan	200-300°C
101	Tan, grey	200-500°C
102	Brown, grey	200-500°C
104	Tan	200-300°C
105	Tan	200-300°C
106	Tan, grey	200-500°C
107	Tan	200-300°C
108	Tan, grey	200-500°C
109	Brown, grey, white	200-645°C
111	Brown, grey, white	200-645°C
112	Tan, grey, blue	200-645°C
113	Tan, grey, black, white	200-645°C
114(b)	Brown, white	200-645°C
114(b)*	Brown	200-300°C

Table 13 cont. Pobrežje: Temperature of Firing.

Grave Number	Color	Temperature of Firing
116	Tan	200-300°C
117	Tan	200-300°C
117(2)	Tan	200-300°C
120	Tan	200-300°C
122	Tan, white, grey	200-645°C
134	Tan, grey, blue	200-<645°C
135	Tan, grey, blue, white	200-645°C
137	Tan, white, blue	200-645°C
137*	Tan, grey, white	200-645°C
138	Tan	200-300°C
139	Tan, white	200-645°C
141	Brown, white	200-645°C
144	Brown	200-300°C
147	Tan, black	200-500°C
148	Tan, grey	200-500°C
153	Brown, grey	200-500°C
156	Tan	200-300°C
164	Tan	200-300°C

171	Tan, grey	200-500°C
173	Grey	200-500°C
175	Brown, grey, blue	200-645°C
177	Brown, grey	200-500°C
178	Tan, grey, white	200-645°C
226	Tan, blue, grey	200-<645°C

Table 13. Pobrežje: Temperature of Firing.

Table 13 shows the coloration and temperature of firing of the remains from Pobrežje. Graves 3, 14, 32, 36, 63, 80, 84, 86, 91, 96(2), 101, 102, 106, 108, 147, 148, 153, 171, 173, 175, and 177 exhibit bones which are tan, dark brown and grey in color. This coloration is typical of low temperatures, approximately 200-500°C, with areas rising to slightly higher temperatures as bones are slowly starting to blacken on the edges. Graves 19 and 27 bones are dark grey, blue, and white in color (500->645). This type of burning is typical of exposure to high temperatures, over 645°C as bones are starting to reach complete calcination. Bones from 76 are buff-colored and white, indicative of constant temperatures over 645°C. This is the only grave from Pobrežje which exhibits completely calcined bone fragments. Graves 1, 26, 39, 55, 56, 59, 61, 72, 79, 85, 87, 97, 97(2), 98, 100, 104, 105, 107, 114b(2), 116, 117, 117(2), 120, 138, 144, 156, and 164 are tan in color, indicating low temperatures of 200-300°C. Graves 57, 63(2), 66, 68, 70, 73, 75, 78, 81-75d, 83, 94, 96, 109, 111, 112, 113, 114b, 122, 134, 135, 137, 137(2), 139, 141, 178, and 226 are tan, dark brown, dark blue, black, and grey with slightly white edges; this indicates that temperatures reached a range of temperatures, from 200-645°C.

In total from Pobrežje, there are 27 individuals within the 200-300°C range, 21 individuals within the 200-500°C range, 26 individuals within 200-645°C, 2 within 500-645°C, and only one individual at over 645°C. Although there were 26 individuals within the range of 200-645°C, the majority of the fragments from these assemblages were light brown and burned at low temperatures.

Site	200-300°C	200-500°C	200-645°C	500-645°C	>645°C
Ruše	14	2	7	1	2
Brinjeva gora	4	20	26	15	1
Pobrežje	27	21	26	2	1

Table 14. Number of assemblages in each temperature category by site.

Table 14 shows the number of assemblages from each site in each temperature category. From all three sites, there are 55 graves in the 200-300°C category, 43 graves in the 200-500°C category, 59 in the 200-645°C category, 18 in the 500-645°C category, and 4 in the >645°C category. Although there are 59 assemblages which exhibited a range of temperatures from 200-645°C, it is somewhat misleading as the majority of the bone fragments from each of these assemblages were burned very lightly, ranging from 200-300°C. There were only four assemblages from all three sites which were completely calcined.

Figure 11. Dental fragments from several graves showing differential burning.

From the three sites, the overall degree of burning is relatively low (Figure 12). The coloration patterns found on the bones from Ruše and Pobrežje are very similar, being tan or light brown in color and mostly ranging from 200-500°C. The bones from Brinjeva gora have been burned at hotter temperatures, many of the assemblages up to 500°C and 645°C.

Figure 12. Bone fragments showing low degree of burning.

5.6 Fracture Patterns

The cremated remains from all three sites in this study have been subjected to a high level of warping, twisting, longitudinal cracking, serrated diagonal fracturing, and curved lateral and transverse splintering.

Figure 13. U-shaped fissuring on long bone fragment from Ruše 9.

Separation of the inner and outer tables and along sutures has occurred on many cranial fragments due to warping. This type of fracturing is typical of bones burned with the flesh still adhering (Thurman & Willmore, 1980: 281; Mayne Correia, 1997: 279).

There are three graves (Ruše-21, Ruše-1993-32, and Brinjeva gora-40) with slight patina checking on the cortical surface of several long bone fragments; this may be due to cortical exfoliation typical of in-flesh burning (Buikstra & Swegle, 1989: 255), as the rest of the long bone fragments exhibit fracturing consistent with burning with flesh attached to the bones. There were not any differences in fracturing between bone elements.

Figure 14. Rib fragments showing cortical exfoliation and warping.

5.7 Cremation Weights

The weight ranges of the cremated remains from the three sites under study are as follows: Ruše – 1.1 grams (Grave 14B) to 300.4 grams (Grave 1993-8), Brinjeva gora – 2.4 grams (Grave 33) to 544.1 grams (Grave 28), Pobrežje – 2.4 grams (Grave 104) to 573.7 grams (Grave 135). Of the total of 169 cremations, 148 (87.5%) weighed under 200 grams.

The total cremated bone weight and average cremation weight per site is shown in Table 15. The total combined weights from all 26 cremated assemblages from Ruše are just over 1450 grams, with the average cremation weight being only 55.82 grams.

The total cremation weight from Brinjeva gora is much higher than that of Ruše, but this can be explained by the 40 additional individuals. Despite an increase in cremation weights, the mean weight per assemblage is low, only 89.54 grams.

There is a 4000 gram increase in total bone weight in the remains from Pobrežje in comparison with Brinjeva gora, which has only 11 more individuals. This slight increase in weight per individual is reflected in the average weight per individual which is just over 122 grams.

Site	No. of Individuals	Total cremated bone weight	Average weight per cremation
Ruše	26	1451.3 grams	55.82 grams
Brinjeva gora	66	5909.6 grams	89.54 grams
Pobrežje	77	9397.3 grams	122.04 grams

Table 15. Total/average cremation weight per site.

The following three tables (Tables 16-18) illustrate the weight of the cremated remains per individual.

Grave Number	Total bone weight (grams)
3	9.9
4	7.3
9	8.4
10	85.7
11	27.6
11B	10.1
13	51.2
13B	17.1
14	13.9
14B	1.1
16	144.2
18	39.6
19	129.6
19(2)	2.0
20	15.8
21	31.9
23	63.0
26	8.9
29	27.5
29B	4.0
29(2)	12.0
34	18.2
86	19.3
1993-8	300.4
1993-9	112.0
1993-32	290.6

Table 16. Ruše: Weights per individual.

Table 16 shows the weights for the 26 individuals from Ruše. The weights range from 1.1 grams to 300.4 grams. These weights do not tie in with age at death. Adult individuals would be expected to have higher bone weights than juveniles or infants, but with the individuals from Ruše, the low weights are directly related to the amounts collected for burial and not younger individuals. The weights also cannot be attributed to the sex of the individual. Male individuals are considered to weigh more than female individuals; however the three individuals from Ruše which have a determination of sex are only represented by small amounts which are related again to collection methods rather than sex of the individual.

Grave Number	Total bone weight (grams)
1	85.1
2	115.7
3	65.4
6	24.0
7	43.4
9	39.7
10	194.7
12	368.4
13	38.5
14	15.5
15	83.8
15B	25.3
17	32.1
19	10.6
20	116.6
21	129.0
22	7.5
23	121.3
24	105.6
25	112.6
26	47.4
27	326.1
28	544.1
29	8.8
30	77.7
31A	15.6
31B	48.1

Table 17. Brinjeva gora: Weights per individual.

Grave Number	Total bone weight (grams)
32	39.8
33	2.4
34	401.7
34(2)	130.9
35	126.2
35(2)	66.1
36	29.3
37	25.1
38B	51.8
38(2)	29.4
39	19.5
39B	2.7
40	106.4
42	41.6
43	25.8
44	21.6
45	89.8
47	92.2
49	37.7
50	70.8
51	56.1
52	49.9
53	129.4
56	176.4
57	37.5
58	72.5
59	33.0
60	97.7
61	65.8
62	34.6
63	53.8
65	13.2
68	50.0
68(2)	226.7
70	72.7
70(2)	23.1
72	45.6
73	60.1
77	385.5

Table 17 cont. Brinjeva gora: Weights per individual.

Table 17 shows the weights for the 66 individuals from Brinjeva gora. The weights range from 2.4 grams to 544.1 grams. As with Ruše, the bone weights are not directly related to age at death or sex of the individuals as the low weights are directly related to the amounts collected for burial and not younger individuals.

Grave Number	Total bone weight (grams)
1	56.3
3	32.3
14	160.3
19	146.1
26	420.4
27	130.7
32	144.6
36	307.9
39	125.9
55	44.5
56	37.0
57	302.3
59	95.9
61	15.3
63	130.5
63(2)	9.2
66	3.9
68	176.5
70	35.3
72	34.2
73	152.1
75	66.6
76	9.6
78	54.8
79	130.4
80	20.0
81	136.3
83	14.7
84	248.6
85	143.4
86	228.9
87	57.5
91	259.9
94	467.0
96	106.7
96(2)	2.5
97	41.9
97(2)	8.6
98	39.4

Table 18. Pobrežje: Weights per individual.

Grave	Total bone weight

Number	(grams)
100	13.0
101	232.7
102	35.8
104	2.4
105	17.5
106	149.3
107	196.9
108	76.6
109	29.1
111	91.9
112	156.1
113	148.5
114B	14.5
114B(2)	33.0
116	15.7
117	5.1
117(2)	5.5
120	13.7
122	312.6
134	330.4
135	573.7
137	155.4
137(2)	163.9
138	15.5
139	62.2
141	79.5
144	57.5
147	133.6
148	117.3
153	111.2
156	147.2
164	186.1
171	295.5
173	112.5
175	56.9
177	49.8
178	57.0
226	543.5

Table 18 cont. Pobrežje: Weights per individual.

Table 18 shows the weights for the 66 individuals from Pobrežje. The weights range from 2.4 grams to 573.7 grams. There is no correlation between age at death or a determination of sex and the weights collected. While is it assumed that there would be higher weights for adult individuals compared to juveniles and possibly males compared to females, the weights collected for most individuals are so minute that it cannot be inferred that higher weights are from adults or males.

The Slovenian remains generally reflect an overall low collection amount per cremation, even allowing for the fact that several of the graves contain the remains of an infant. In this situation, it is clear that the weights do not represent the size of the deceased individual, but rather the amount collected for burial.

5.8 Weights by Fragment Size

The breakdown of total weight according to fragment size from each site is as follows (Table 19 & Figure 15). This table includes the weights for all individuals from each site. The relative proportions of bone by weight from the 10 mm, 5 mm, and 2 mm mesh sieves represent relatively large fragment size and good preservation of bone as the majority of the remains from each site were collected from the 10 mm mesh.

Site	10 mm	5 mm	2 mm	Total weight
Ruše	973.2 grams (67%)	361.9 grams (25%)	116.2 grams (8%)	1451.3 grams (100%)
Brinjeva gora	2979.3 grams (51%)	2493.8 grams (42%)	436.5 grams (7%)	5909.6 grams (100%)
Pobrežje	6562.4 grams (70%)	2417.3 grams (26%)	417.6 grams (4%)	9397.3 grams (100%)

Table 19. Weight (g) of cremated bone from 10 mm, 5 mm, and 2 mm mesh sieves per site.

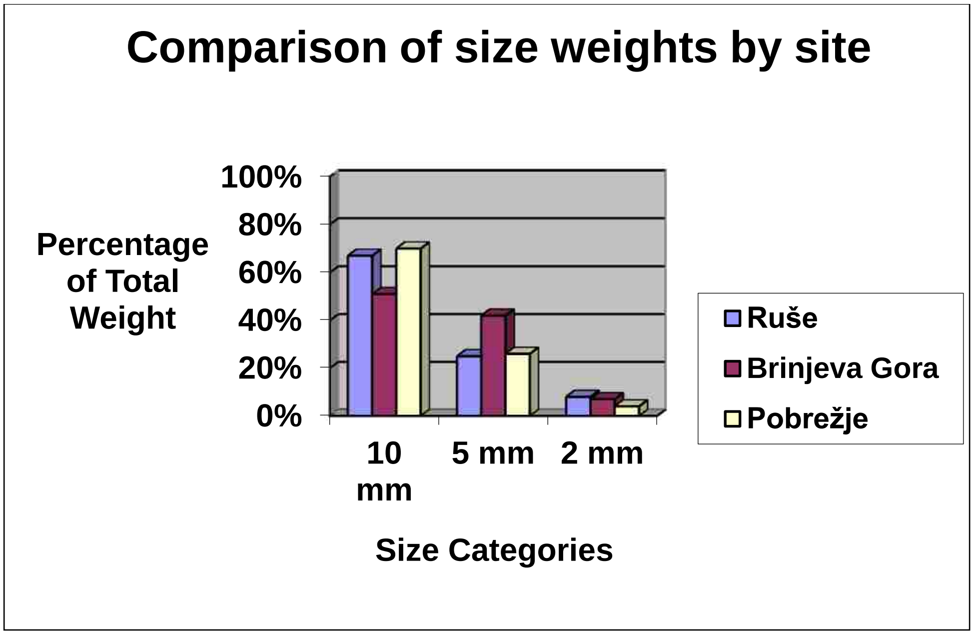

Figure 15. Comparison of size weights across all three sites.

As shown in Figure 15, the majority of the remains from all three sites were larger than 10 mm. The weight proportions for Ruše are 67%, 25%, and 8% with the largest bone fragment being a 70 mm piece of a long bone shaft. Weight proportions for Gračič are 51%, 42%, and 7% with a cranial fragment measuring 73.5 mm being the largest bone fragment. Weight proportions from Pobrežje are 70%, 26%, and 4%, with a 95 mm long bone shaft fragment being the largest piece from this site assemblage. Over 60% of the fragments from Ruše and Pobrežje are from the 10 mm size category, with just over 50% for Brinjeva gora. The lower percentage of 10 mm fragments from Brinjeva gora can be explained by the increase in remains found in the 5 mm category which are over 40%. Fragments from the 2 mm size category made up a very small percentage of bone weight.

5.9 Weights by Skeletal Element

Table 20 shows the comparison of skeletal element survival across all three sites under study.

Skeletal Area	Ruše	Brinjeva gora	Pobrežje	Total	% of Total
Skull	245.0	1334.4	1589.7	3169.1	19%
Long Bone	704.5	3535.2	5675.5	9915.2	59%
Ribs	12.4	19.5	75.5	107.4	<1%
Hand/Foot	10.0	17.8	106.1	133.9	<1%
Scapula	9.0	26.2	125.1	160.3	<1%
Vertebra	9.5	5.8	126.0	141.3	<1%
Pelvis	11.4	12.1	142.0	165.5	<1%
Clavicle	0.0	1.5	1.5	3.0	<1%
Dentition	0.0	4.8	1.6	6.4	<1%
Patella	0.0	2.2	27.5	29.7	<1%
Sternum	0.0	0.0	2.8	2.8	<1%
Sacrum	0.0	0.0	3.1	3.1	<1%
Animal	5.1	31.3	20.9	57.3	<1%
Unidentified	444.4	918.8	1500.0	2863.2	17%
Total	1451.3	5909.6	9397.3	16758.2	100%

Table 20. Comparison of the total skeletal element weights across all three sites.

In all three Slovenian sites under study, the ratio of identified to unidentified bone fragments is extremely good. As shown above, the bones from all skeletal areas were identified across all three sites, with the majority of the bones having been collected and identified being skull and long bone fragments. While this may reflect possible collection bias, both the cranium and long bones tend to survive cremation better than other areas of the body, which may explain why these fragments comprise the majority of the cremations. All of the other recognizable skeletal elements were represented by less than 1%, indicating either collection bias or lack of survival from the cremation process.

5.10 Animal Bones

Animal bones were present in 30 out of 169 cremations or 18% and detailed information is included in the Appendix. Animal bones recovered from cremations which could be identified to species are shown in Table 21.

Site	Grave Number	Animal	Description
Brinjeva gora	34	Sheep/goat	Ribs
Brinjeva gora	37	Cow	Patella
Pobrežje	1	Pig	Maxilla
Pobrežje	57	Red deer; pig	Distal epiphysis of femur; mandible
Pobrežje	85	Pig	Occipital bone
Pobrežje	101	Red deer	Distal epiphysis of femur
Pobrežje	122	Sheep/goat	Left maxilla (molar region); atlas
Pobrežje	137	Marten	Mandibular ramus

Table 21. Identifiable animal bones recovered from analyzed cremations (B. Toškan & J. Dirjec, personal communication, July 2008).

Several bones from assemblages from Brinjeva gora and Pobrežje were identifiable to a specific skeletal element and specific species by zooarchaeologists Dr. B. Toškan & J. Dirjec of the Scientific Research Center of the Slovenian Academy for Sciences and Arts in Ljubljana, Slovenia. These bones represent a range of animals, both domesticated and non-domesticated, including cow (*Bos taurus)*, pig (*Sus scrofa*), sheep (*Ovis aries*), goat (*Capra aegagrus),* red deer (*Cervus elaphus)*, and a member of the Mustelidae family (possibly stone marten). There were animal bones recovered from 18 bone assemblages in total, but the fragments could only be identified as non-human and not to a specific species.

5.11 Concluding Remarks

The development of this osteological data has resulted in a wealth of information which can be utilized in conjunction with other archaeological research from the selected sites under study. The following chapter discusses the results of this study which are compared with studies of other cultures practicing cremation and the implications of the funerary methods performed in Slovenian Styria.

CHAPTER VI

DISCUSSION

Within this chapter, the results from the osteological analysis are compared with existing knowledge from other cremation studies and placed into a wider context involving current research on mortuary practices of the Urnfield Culture in eastern Slovenia. This section also includes a comparative analysis of fragment size, skeletal element survival and weight distribution per site and a discussion of resulting fracture patterns and coloration changes due to the cremation process, the efficiency of the cremation process at each site, the overall site demographics, and the presence of animal bones within the cremations. Due to the small number of published reports on cremated remains from Late Bronze Age sites in Slovenia and Central Europe, the results are also compared with the Anglo-Saxon site of Spong Hill which produced thousands of cremation assemblages, in addition to several Scottish Bronze Age cremations and multiple world-wide ethnographic and archaeological parallels.

6.1 Number of Individuals

As discussed in Chapter 5, the remains from 169 bone assemblages were analyzed in this study. During the analysis, the possibility arose that several of the bone assemblages may include the remains of one individual. All of the assemblages contained incomplete skeletons and there was nothing specific within the remains that would have indicated that multiple assemblages contained the separated remains of one individual. As a result, the bones from each assemblage were considered to be from one individual and recorded as such, making the total number of individuals analyzed 169.

The lack of multiple individuals from the studied Slovenian cremation assemblages is not uncommon. From the Anglo-Saxon site of Spong Hill, McKinley recorded 4.1% of the burials as containing two individuals. Of those burials, 7.8% contained the remains of two immature individuals, 70% were of an adult and an immature individual, and 22.2% were of two adult individuals (McKinley, 1994b: 100).

She reports that other contemporaneous cremation sites in England feature low percentages of multiple burials, as do several sites in Europe (McKinley, 1994b: 100).

It has been reported the majority of dual burials are of an adult individual with a juvenile or infant (McKinley, 1994b: 100). McKinley reports that although there was nothing to prove that there was a relationship between the deceased individuals placed in a dual burial, it is likely that there was some kind of relationship for them to be buried so closely together (1994b: 100-101). She suggests a mother-child relationship for several of the adult individuals buried with children and possibly a married couple for the adult individuals buried together; these relationships cannot be conclusive, however McKinley does indicate that the individuals may have maintained a close relationship during life for them to be buried together in death (1994b: 101).

From 2007 to 2009, the author had the opportunity to analyze six cremation assemblages from six Bronze Age sites (Achnacreebeag, Dunion Hill, Easter Gellybank, Arran, Blairmore, and Aberdeenshire) in Scotland. During the Bronze Age, cremation was the primary burial rite in Scotland and individuals were burned on pyres and the remains placed into barrows or chambered cairns. While Scottish cremations are not directly comparable due to being geographically different, they provide a useful means of comparison for the Slovenian assemblages.

Of those six Scottish burials, two of the assemblages, Arran and Easter Gellybank, contained more than one individual. The assemblage from Arran contained the remains of an adult individual and an infant. Although the assemblage was small, it was clear that there were two individuals based on the thick cranial fragments and a humerus fragment of a neonate individual (Thomas, 2007f: 3). The limb bone was the only fragment from the neonate individual and it was not possible to narrow down the age range of the adult individual based on the fragments present.

The Easter Gellybank cremation contained the remains of three individuals, based on the presence of duplicate fragments and both mature and immature bones. These bones represented the remains of two adult individuals and one juvenile individual. The duplicate bones were six petrous bones, 3 from the left side and 3 from the right side. From the juvenile individual, there were several teeth with incomplete roots and long bones with unfused epiphyses (Thomas, 2007a: 5). From one of the adults, there was a skull fragment with a moderately closed suture, indicating an older individual. It was not possible to narrow down the age range of the other adult individual.

One double burial has been reported from an Urnfield Culture site of Le Caprine near Guidonia, Rome in Central Italy. From this site, researchers studied the burned remains from five graves with the aim of establishing the MNI for grave and cremation patterns (Rubini, Licitra, & Baleani, 1997: 1). The authors reported that the number of individuals from each grave was determined based on the non-repetition of bone fragments, bone consistency, skeletal maturity, and bone dimensions (Rubini et al, 1997: 4). The bones of an adult male and an infant were found within a large dolium and a hut-urn at the bottom of Grave 2; despite a careful analysis of the burning patterns, the authors stated that it was not possible to determine whether or not the individuals had been burned together on the same pyre or one after the other (Rubini et al., 1997: 5).

From the Late Bronze Age site of Békásmegyer from Budapest, the cremated remains from 248 individuals were analyzed. It was discovered that there were seven complete double burials and 18 burials with an admixture of other individuals (Heußner, 2010: 312-313). Heußner discusses how the commingled burials may have been a result of accidental mixing from nearby pyres or burials or deliberate mixing during the burial ceremony (2010: 313). She considers the number of double burials from Békásmegyer to be relatively low and the 18 commingled burials to be remarkably high for such a large assemblage (Heußner, 2010: 313).

The absence of multiple burials from the Slovenian assemblages under study can be attributed to one of several explanations. First, it may be possible that each deceased individual was placed into their own urn and that the remains of more than one individual were not commingled after firing, thus explaining only single burials. It may also be that there were multiple individuals placed into the same grave, but due to the small size of each deposit, there is a lack of evidence (i.e. duplicate bones) which would have clearly shown the presence of more than one individual. Because of the absence of duplicate burials, it is not possible to try and evaluate the possibility of family members being buried together within the Slovenian cemeteries.

6.2 Age of Individuals

As shown in Chapter 5, age at death could be established for approximately 73% of the individuals. While this percentage elucidates to a large proportion of the individuals having assigned ages, it is important to emphasize the fact that many of them were assigned broad ranges such as ‘adult’ or ‘infant’. Due to the low percentage of fragments recovered from each assemblage, the age ranges could not be narrowed to a specific numeric range. This must be kept in mind when considering the age percentage for the studied Slovenian individuals in comparison with other osteological and cremation studies.

In comparison with other cremation studies, this percentage is substantially lower. At the Scottish cemetery site of Skilmafilly, McSweeney was able to provide an estimation of age for 35 out of 42 individuals or 87%, with 13 being immature individuals and 22 adults (2001: 23-24). At the early Bronze Age site of Sketewan located in northern Scotland, the cremated remains from 17 burial contexts were analyzed. A total of 22 individuals were identified and McSweeney reports that age at death was accurately assigned for 96% of the individuals (McSweeney, 1997: 312; McSweeney, 2001: 22). The majority of McSweeney’s age determinations were made based on epiphyseal fusion, cranial wall thickness, and overall bone morphology (McSweeney, 1997: 313).

Of the 14 adults from Sketewan, there was no evidence of advanced adulthood; however, this was mainly due to the absence of certain features such as the dental enamel or the vertebral bodies which would have shown varying degrees of attrition and possibly degeneration (McSweeney, 1997: 312). Of the seven juvenile individuals, none could be placed as older than 7 years old with 3 being neonate and one being a perinate (McSweeney, 1997: 312). The 22nd individual, which could not be aged, was discussed by McSweeney as possibly being either a young adult or child (McSweeney, 1997: 312). McSweeney discusses that based on the age determinations, it would appear that at Sketewan there was a high mortality rate during the first six years of life, but after this age the chances of surviving until adulthood were fairly good (1997: 313).

At the Early Saxon site of Spong Hill, in Norfolk (England), McKinley reported that age at death could be established for at least 96% of the 2259 cremated individuals. Age categories such as 'infant/juvenile', and 'young/mature adult' were used instead of specific ages and she observed that the age categories for many individuals overlapped to create larger age ranges (McKinley, 1994b: 68). She discusses how the mean age of death at Spong Hill was within the 'older mature adult' category, but she speculates that if an adjustment is made for the young infants which were likely to be missing from the sample population, the mean age would have fallen within the 'young adult' category (McKinley, 1994b: 68).

As discussed in Chapter 3, an osteological analysis was completed on a collection cremated remains from five graves from the site of Gorice near Turnišče. Using ageing techniques such as epiphyseal fusion, dental development, and morphological changes, Šlaus was able to determine the approximate age of the individuals from the four graves containing human remains (2010: 125-126). For three out of the four individuals, his determinations were based on the thickness and density of cortical bone and large age ranges were provided, as a more precise range could not be established (Šlaus, 2010: 125-126).

As discussed in Chapter 3, the osteological data from the biritual cemetery of Križna gora was published in 1974. A total of 153 graves with 62 inhumations were discovered, however only 36 sets of skeletal remains were analyzed (Urleb, 1974: 27). Age was determined for all 36 individuals; it was determined that there were 12 males, with four being considered to be over 50 years old and the remaining 8 individuals aged between 20-40 years. Only one of the females was determined to be over 50, the other six women aged between 20-40 years (Urleb, 1974: 27).

The age categories used by McSweeney, McKinley, Urleb, and Šlaus are similar to those used when establishing approximate ages for the studied Slovenian remains as broad age ranges and terms such as 'infant', 'juvenile', and 'adult' were utilized. It would not have been possible to apply all of McKinley's age categories as there was not enough information present from the remains to assign each individual to a narrow range. Many of the skeletons from Spong Hill were able to be placed into categories such as 'older infant' or 'older juvenile' where with many of the analyzed Slovenian remains, there was only enough information to assign the individual to either the 'infant', 'juvenile', or 'adult' category.

As discussed in Chapter 5, there were 124 out of 169 studied Slovenian individuals which were assigned an estimation of age. From all three sites combined, there were five infants, four sub-adults, two individuals between 21-30 years, 1 'young adult', 2 'older adults', 38 'adults', 15 queried "adults", 34 individuals assigned a minimum age, and 23 individuals assigned with a maximum minimum age and a determination of adult.

The lower percentage of 73% is not surprising given the more limited nature of the remains from Ruše, Brinjeva gora, and Pobrežje. The majority of the Spong Hill cremations were comprised of hundreds, and in some cases, thousands of grams of bone material; in contrast with the Slovenian sites under study, as discussed in Chapter 5, it has been concluded that only a small proportion of the cremated remains were collected for burial, as 87% of the graves contained less than 200 grams of bone. In many cases this makes it more difficult to determine age at death from skeletal remains since certain features must be present in order for the osteologist to make an accurate age estimation. However, difficulty in determining the age of an individual can occur with complete and unburned skeletons as well as cremated remains. As discussed in Chapter 4, it may not be possible to accurately age the individual, despite having a large proportion of the skeleton and it is important that cremation assemblages not be considered informationally insignificant because of the small or fragmented state of the remains.

Several researchers have discussed how the demographic profile of an archaeological assemblage is likely to reflect that of an undeveloped country in that there is a high infant and child mortality rate with fewer people living to older ages (Roberts & Manchester, 1999: 24; Roberts & Manchester, 2005: 38; Chamberlain, 2006: 58-59; Waldron, 2007: 32). Despite the expected higher juvenile mortality rates in archaeological populations, an important consideration for osteologists to make when assessing the demographic profile of a cemetery population is the underrepresentation of young individuals. Pinhasi & Bourbou state that the low numbers of infant remains recovered from archaeological sites cannot be explained by taphonomic factors, but rather is most likely due to burial practices and archaeological recovery strategies (2008: 33).

In 2008, an article was published discussing the cremated remains from numerous archaeological sites in southwestern Germany. Over 750 individuals from 75 burial sites ranging from the Urnfield Culture, the LaTene period, and the Imperial Roman period have been investigated (Wahl, 2008: 146-147). Wahl discusses how during the Urnfield Culture, the average percentage of immature individuals recovered from each burial site was 8.5% with the average from the Hallstatt or La Tene period being 21.1% and over 30% recovered from the Imperial Roman Period (Wahl, 2008: 153).

At Békásmegyer, out of the 248 individuals, 5 individuals were only given the classification of being 'human' and were not included in any further analysis (Heußner, 2010: 308). Of the remaining 243 individuals, 191 were assigned to an adult age range (Heußner, 2010: 308). Heußner reports the infant mortality rate for this population as being 17.3%; she comments that this percentage is low in comparison with other anthropologically investigated sites from the same time period, which tend to be approximately 30% (Heußner, 2010: 308).

As discussed in Chapter 5, only five infants and four individuals under the age of 23 were identified from all three Slovenian sites, with two from Ruše, two from Brinjeva gora, and five from Pobrežje. This small group of remains represents just over 5% of the total population studied. This is an extremely low number of individuals when the infant mortality rates of ancient populations are taken into consideration. It is possible that the infant and juvenile remains may have been treated in a different manner or that they may have been buried in another area of the cemeteries which had not been excavated. It is also important to consider that the underrepresentation of infant and juvenile remains may be due to excavation and recovery techniques and the disregard for such small fragments. If only small amounts of the infants were collected for burial, it may also be that, despite protection from a cinerary urn, the remains did not survive or were discarded.

Age determinations from all six analyzed Scottish sites were established based on epiphyseal fusion and cranial thickness, which were the two methods which were most commonly used in the Slovenian assemblages. Five out of the six Scottish assemblages (excluding Easter Gellybank) were comprised of small amounts of bone, ranging from 9.01 grams to 258.15 grams. The small assemblages contained few age-related features, as was found with the Slovenian remains; such minute collections caused the age determinations to be restricted to broad categories or minimum ages, rather than precise age ranges or intervals.

At the Bronze Age funerary site of Loth Road in Sanday, Orkney, Scotland, a cremation burial was discovered containing just 13.8 grams of burned bone. Despite such a small amount, Roberts was able to identify the remains of two individuals, an infant and an adult, based on the cortical thickness and size of the fragments (Roberts, 2007: 11). This is surprising since most small cremation assemblages do not contain the age-related features needed to make an accurate determination; however, as with the Slovenian cremations, Spong Hill, and the Scottish cremations analyzed by the author, Roberts was restricted to using broad age categories rather than exact ages.

Despite the large temporal difference, it is important to note the work of J. Angel and his research on the Mecklenberg Collection, which is housed in the Peabody Museum at Harvard University (Angel, 1968). His study, as mentioned in Chapter 3, involved the osteological analysis of inhumed skeletal remains from the Early Iron Age site of Magdalenska gora in central Slovenia, approximately 60 miles to the west of the three sites studied. Angel determined that, based on 32 adult individuals, the average age at death for males was 40.7 years and 31.3 years for females, with women having a shorter life span due to physical labor and childbirth (Angel, 1968: 98).

It was not possible to construct an average age at death for the sample population under study or determine whether there was a bias towards one particular age group being buried in the cemeteries, as the age determinations were mainly limited to broad age categories. Despite the regional and temporal similarities, it cannot be assumed that average age at death for the three selected Slovenian sites was between 30 and 40 years of age as with the sample from the Slovenian site of Magdalenska gora.

6.3 Sexing the Individuals

As discussed in Chapter 5, there were only eight individuals or 4.7% for which sex could be determined: four males and four females. At the site of Spong Hill, McKinley was only able to accurately sex 38.4% of the population under study (1994b: 68). While 38% represents only just over a third of the population from Spong Hill being sexed, it is much higher than the percentage found from the three Slovenian sites studied. Frequently recovered from the Spong Hill cremations were fragments of the innominate bone, the most reliable bone from which to determine the sex of an individual. These fragments, in addition to the well-represented cranial bones, were used by McKinley to establish the sex of the individuals. She was also able to utilize various measurements such as the diameter of the radial head for determining sex of certain individuals.

McKinley found that of the adult individuals that could be sexed, 61.2% were determined to be female and 38.8% to be male (McKinley, 1994b: 68). She attributes the higher percentage of females this to a potential bias in assigning young adults that have not fully developed masculine traits as females (McKinley, 1994b: 68). She discusses how the natural overlap in sexual dimorphism between the individuals would have been accentuated due to the cremated state of the remains, as partial recovery and the lack of certain skeletal elements would have prevented an accurate determination of sex (McKinley, 1994b: 68-69).

It was not possible to rely on fragments of the innominate bone for determining sex, as there were only few which survived in the analyzed Slovenian assemblages, and of those only two cremations had sexually dimorphic features which could be used. The majority of the cranial fragments present were vault fragments which could not be used for determining sex. Of all the bone fragments, there was only one measurement, the diameter of the radial head, which could be taken which would provide information which could be used to determine sex. All of the other remains were too fragmented to obtain accurate measurements.

As previously mentioned above, most of the assemblages at Spong Hill contained hundreds of grams of bone material as opposed to those from the studied Slovenian collections which had smaller assemblages. With larger amounts of human remains, the likelihood of each assemblage including the sexually dimorphic features needed to make a determination of sex is higher. It is likely that the small amounts of cremated bone from each examined Slovenian assemblage played a significant role in preventing the determination of sex from being ascertained from most cremations.

From the Scottish cremations analyzed by the author, only two of the six assemblages had cranial fragments which exhibited sexually dimorphic characteristics which could be confidently used to establish a determination of sex. From Easter Gellybank, there were two small fragments of an orbital ridge and a mastoid process which was used to estimate sex. The fragments of the orbital ridge appear to have a sharp superior margin and although this is generally a juvenile or female characteristic and could be from any of the three individuals, due to the fragmentary nature of the bone and the diminutive size, it is not sufficient evidence to make an accurate determination of sex for any of the individuals (Thomas, 2007a: 5). Despite the possibility of shrinkage due to being subject to heat and the possibility of it being smaller due to being from the juvenile individual, the mastoid process is still very small and gracile, which is generally typical of a female individual. From the other remains present, there were not any fragments of sexually dimorphic features that would provide an accurate indication of sex for any of the individuals.

There was one orbital ridge fragment from the Bronze Age site of Dunion Hill which was used to determine the sex of the individual. This fragment exhibits a sharp superior margin, which is a typically juvenile or female characteristic. While it can be supposed that the individual is female, this fragment does not provide sufficient evidence to make an accurate determination of sex for this individual as normal variation within a population produces small, gracile males and large, robust females.

At the Scottish site of Skilmafilly, McSweeney was able to estimate the sex of 13 out of 23 individuals or 57% (McSweeney, 1997: 313). Of the 13, seven were determined to be female and six were determined to be male and from this small sample. McSweeney determined that there was no bias towards either sex being buried at the site; she states that Skilmafilly must have been used as a burial place for the community as a whole and that it was not preserved for a specific group of individuals (McSweeney, 1997: 313).

At the site of Gorice, Šlaus was able to determine the sex of all four individuals recovered from the cremation graves. Of these four, one was determined to be male, the other three most likely female. While this provides Šlaus with a 100% estimation rate, it would appear from the photographs that the assemblages were small in size; weights are not included in the publication (Šlaus, 2010: 125). Šlaus uses the thickness of the cranial vault to determine sex, which is not a commonly used method for estimating sex, and without other definite features from which to establish sex from, these determinations must be cautiously considered.

Out of the 248 individuals from Békásmegyer, Heußner was only able to provide an estimation of sex for 66 adult individuals or nearly 27%. An estimation of sex was not attempted for any of the juvenile remains. Of the 66 individuals, 38 were found to be male and 28 were female (Heußner, 2010: 312). Heußner reports that in several cases, a determination of 'male' was assigned solely on the robusticity of the long bone fragments (2010: 312). While is it possible that these individuals are male, it is important to keep in mind that these remains may be from robust females.

In 2001, M. J. Becker analyzed a collection of 19 Classical cremation assemblages curated in the National Museum of Denmark. The bones were retrieved from mortuary vessels and Becker was able to determine the sex of 15 out of 19 individuals or 78.9%. Ten of the individuals were determined to be female, the majority being younger women in their 20s (Becker, 2001: 1). He suggests that the high percentage of younger adult women were likely to have been married and died in childbirth (2001: 1).

Table 22 provides the sample size studied from each site and the corresponding percentage of the remains which were assigned an identification of sex.

Sample Population	Sample Size	Percentage of Sexually Assigned Individuals	Author
Gorice, Slovenia	4	100%	Šlaus, 2008
Békásmegyer, Hungary	248	26.6%	Heußner, 2010
19 Classical sites, Denmark	19	78.9%	Becker, 2001
Skilmafilly, Scotland	23	57%	McSweeney, 1997
Spong Hill, England	2259	38.4%	McKinley, 1994
Ruše, Brinjeva gora, Pobrežje, Slovenia	169	4.7%	Thomas, 2010

Table 22. Percentage of sex determinations per site.

As previously discussed, the difficulty in establishing sex was apparent with the analyzed Slovenian cremations as only one out of the nine individuals (Grave 27 from Pobrežje) had fragments which allowed for a confident determination of sex. The other eight individuals only had possible determinations of sex due to the lack of sexually dimorphic features. As with age, difficulty in determining sex can be directly related to the amounts collected for burial. Unless sexually dimorphic features are present within the assemblage, the osteologist must rely on the degree of robusticity of the remains, and even this methodology is not always reliable due to normal variation within every population. If only small assemblages are collected, then the chance of features being included which will aid in establishing sex is low. Due to such a low percentage of males and females from this Slovenian population, any discussion on sexual distribution between sites or prevalence of one sex being recovered more than another would be meaningless and thus, was not attempted.

6.4 Pathology

When working with skeletal remains, it can be difficult to make an accurate diagnosis of the condition and identify the etiology of the disease. Occasionally a diagnosis is not possible due to the limited way in which bones react to disease processes. In most cases, pathologies are assigned to broad categories instead of specific diagnoses. As discussed in Chapter 5, the two conditions discovered during the osteological analyses were cases of metabolic and joint disease.

Two of the individuals analyzed exhibited signs of joint disease in the vertebral column. In the spine, spinal osteophytosis is characterized by osteophytic growth on the margins of the vertebral bodies, increased porosity, and/or small indentations in the center known as Schmorl's nodes; these changes are the overall effects of intervertebral disk degeneration (Roberts & Cox, 2003: 31). According to Roberts & Manchester, the 5^{th} cervical, the 8^{th} thoracic, and the 4^{th} lumbar vertebrae are the most susceptible to joint disease due to the normal curvature of the spine (2005: 139). Degenerative disc disease can occur with increasing age, obesity, genetic factors, occupation, or maligned fracturing and according to Rogers (2000: 166). Spinal osteophytosis tends to occur more frequently in women than men and more frequently in the individuals engaged in heavy labor than in sedentary workers (Larsen, 1997: 176; Roberts & Manchester, 1999: 107; Roberts & Cox, 2003: 32; Roberts & Manchester, 2005: 138, 140).

The seven remaining individuals showed signs of porotic hyperostosis. Porotic hyperostosis is a hematopoietic disorder causing lesions of the cranial vault due to overactivity of the bone marrow, resulting in hypertrophy of the diploë and thinning of the outer cranial table (Stuart-Macadam, 1985: 394; Stuart-Macadam, 1992: 39; Larsen, 1997: 30; Roberts & Manchester, 2005: 229; White & Folkens, 2005: 320; Lewis, 2007: 111). When the outer bone layers of the cranial vault become porous due to thinning, it begins to exhibit a spongy appearance compared to the smooth appearance of healthy bone (Stuart-Macadam, 1987b: 522; Cohen, 1989: 107; Stuart-Macadam, 1998: 47). It has been widely accepted that this condition is indicative of a nutritional deficiency or metabolic disorder (Stuart-Macadam, 1985: 391; Stuart-Macadam, 1987a: 519; Stuart-

Macadam, 1987b: 521; Stuart-Macadam, 1989: 191; Stuart-Macadam, 1992: 40; Larsen, 1997: 30; Brown, 2000: 470; Roberts & Cox, 2003: 234; Walker et al., 2009: 109).

There are several possible etiologies for porotic hyperostosis including rickets, scurvy, syphilis, and anemia. Rickets or osteomalacia develops due to a vitamin D deficiency and results in decalcification of bones (Janssens, 1970: 64, 66; Roberts & Manchester, 2005: 237; Lewis, 2007: 119). Rickets specifically affects the chronodrocytes and growth plate within children, where osteomalacia reflects the effects of the condition on the osteoblastes and their formation of osteoid and osteocalcin in bone modeling and remodeling in adults (Ortner, 2003: 393; Lewis, 2007: 119). Rickets is a systemic disease of early childhood that extensively affects the skeleton; the highest frequency of rickets occurs between 6 months of age and 2 years in the sunless winter months and few cases occur after 4 years of age (Ortner, 2003: 393). Vitamin D can be synthesized in the body with adequate exposure to sunlight and rickets is are rare in societies with reasonably adequate nutrition and exposure to the sun (Ortner, 2003: 393; Roberts & Manchester, 2005: 238). With rickets, there is a process of remodeling of the skull, where the outer table disappears so that the entire thickness of the cranial vault has the porous appearance of diploë and resembles the bone changes in anemia (Ortner, 2003: 394).

Scurvy results when the individual has a prolonged dietary deficiency in ascorbic acid or vitamin C (Ortner, 2003: 383; Lewis, 2007: 126, 128). Vitamin C is imperative for the formation of proline and lysine, amino acids vital for the synthesis of Type 1 collagen, which forms the basis of connective tissues for the skin, blood vessels, cartilage, and bone (Lewis, 2007: 126). This disease manifests itself in diminished or absent bone matrix formations, occurring mostly in the rapidly growing skeleton of the individual (Janssens, 1970: 66; Ortner, 2003: 383). With scurvy, subperiosteal hemorrhages are common on the frontal bone and the orbits and new bone formation and pitting occurs bilaterally across the cranial vault and in the orbits (Ortner, 2003: 386; Roberts & Manchester, 2005: 234; Lewis, 2007: 129).

A type of cranial pitting can also occur with syphilis and various inflammatory infections. With syphilis, there is a distribution of lesions that are usually symmetrical and affects multiple bones; these lesions may also involve the cranial vault, mimicking porotic hyperostosis (Ortner, 2003: 279; Lewis, 2007: 152). Chronic infections of the scalp or inflammatory diseases associated with skull trauma can also cause cranial pitting of the external vault (Ortner, 2003: 102, 193).

Until very recently, archaeologists considered iron-deficiency anemia to be primary cause of porotic hyperostosis. Anemia can be defined as a reduction in the concentration of hemoglobin below the normal level (Stuart-Macadam, 1992: 40; Roberts & Manchester, 2005: 226). As iron is a necessary component for the development and survival of hemoglobin, the lack of iron causes skeletal changes to occur as a result of the body being stimulated to produce more red blood cells in the marrow to compensate for the weaker, shorter living cells (Roberts & Manchester, 2005: 226).

In 1985, Stuart-Macadam stated that porotic hyperostosis tended to reflect iron-deficiency during childhood, when an increase in red marrow cells between the cranial tables places increased stress on the bone (Stuart-Macadam, 1985: 397; Larsen, 1997: 32). The skeletal changes associated with anemia tended to occur during the first two years of life, particularly during the first six months of life (Stuart-Macadam, 1987b: 524; Stuart-Macadam, 1989: 190). She also explained that the presence of porotic hyperostosis seen in adults is a result of growth period bone changes which have not undergone remodeling (Stuart-Macadam, 1985: 392).

Although generally attributed to being due to poor nutritional intake, several theories were proposed by various researchers explaining the cause of iron deficiencies in past populations (Cohen, 1989: 107; Larsen, 1997: 29; Ortner, 2003: 364; Roberts & Cox, 2003: 234; Roberts & Manchester, 2005: 223; Chamberlain, 2006: 161). After the incorporation of farming into society, milled cereal grains such as wheat and millet became important in everyday diet; these foods are high in phytic acid and contain very little iron, which would have contributed to nutritional inadequacy (Stuart-Macadam, 1992: 42; Larsen, 1997: 33; Roberts & Manchester, 2005: 226). In females, iron deficiency tended to result not only an iron-deficient diet, but also from menstruation, childbirth, and lactation, which in turn would result in the breastfeeding child becoming iron-deficient as well (Larsen, 1997: 39; Ortner, 2003: 364; Roberts & Manchester, 2005: 232). During the transition period in which infants are weaned from their mother's milk, children were highly susceptible to developing anemia, as cow's milk has less iron and infants were often susceptible to severe intestinal bleeding (Stuart-Macadam, 1998: 58). In highly sedentary communities, disease tends to be more prevalent owing to unhealthy living conditions, causing an increase in individuals suffering from infections and disease which would have inhibited adequate iron metabolism as the body would withhold iron from pathogens which require iron to survive (Larsen, 1997: 34, 36; Stuart-Macadam, 1992: 41-42; Roberts & Manchester, 2005: 227, 228).

In 2009, a new study was published which challenged the iron-deficiency-anemia hypothesis. The authors of this study explained that is not possible for iron-deficiency anemia to be the etiology of marrow hypertrophy which causes what is recognized as porotic hyperostosis and cribra orbitalia (Walker et al., 2009: 112, 119). They explain that there are other nutrient-deficiency conditions and hereditary hemolytic anemias which are more likely to be responsible for porotic hyperostosis.

The two main hereditary anemias which cause porotic hyperostosis are thalassemia and sicklemia. These anemias are a result of molecular defects within the red blood cells (RBC) which causes bone marrow expansion as RBC destruction exceeds the rate of RBC production (Walker et al., 2009: 112). The authors explain that various kinds of infectious or parasitic diseases, chronic dietary deficiencies and malabsorption of vitamins and/or folic acid can cause various forms of megaloblastic anemia; this type of anemia causes an overproduction of RBCs and leads to cranial pitting (Walker, et al., 2009: 112).

From each individual from the Slovenian assemblage under study, there were only several small fragments which exhibited porotic hyperostosis. As discussed, there are several diseases which can cause porotic hyperostosis and without the full skeleton and a full range of symptoms from one disease or another, it is impossible to establish which disease is responsible for the cranial pitting. What can be established is that these individuals suffered from a metabolic disease, likely due to a nutritional deficiency and a form of megaloblastic anemia.

The low frequency of pathological lesions discovered from the analyzed Slovenian cremations contrasts greatly with the results found by Jacqueline McKinley in her report on the cremations from Spong Hill. Over 30% of the individuals analyzed exhibited some form of pathological lesion or morphological variation (McKinley, 1994b: 106). McKinley was able to recover fragments displaying various dental, joint, infectious, neoplastic, and metabolic diseases, along with signs of isolated lesions, trauma and non-metric morphological variation.

Over 15% of the adult individuals from Spong Hill exhibited evidence of spinal degeneration (McKinley, 1994b: 112). Of the fragments with some degree of disc degeneration, McKinley was also able to identify on which specific vertebrae the lesion was located. From the Slovenian remains in this study, there were only 2 out of 169 individuals or approximately 1% of the sample which exhibited signs of disc degeneration. It was not possible to determine on which vertebrae the lesions were located as the fragments were too small to make an accurate determination.

From the Spong Hill collection, McKinley identified several cases of cribra orbitalia or orbital osteoporosity but did not find any cranial pitting or variable diploë which would have indicated porotic hyperostosis. Cribra orbitalia is thought to be a result of anemia or an iron-deficiency, similar with the cranial lesions found within the Slovenian assemblage as they are likely to have been from a metabolic disease, or more specifically, a nutritional deficiency.

Seventeen out of 42 individuals from the Scottish site of Skilmafilly were reported to exhibit signs of pathological lesions or conditions. The majority of these individuals showed evidence of cranial pitting or spinal degeneration; these lesions are similar with those found on the studied Slovenian remains. McSweeney reports that the cases of cranial pitting or porotic hyperostosis from Skilmafilly are likely to have been a result of an iron-deficiency diet, although disease may have played a role in the changes to the cranial fragments (McSweeney, 2001: 24).

At Sketewan, McSweeney reports that 48% of the individuals exhibited signs of pathological conditions. She reports several cases of degenerative arthritis of the spine with one individual suffering from intervertebral disc herniations and several individuals exhibiting signs of periodontal disease (McSweeney, 1997: 314). She states that due to the poor condition of the remains, the true extent and diagnosis of the lesions could only be speculated upon (McSweeney, 1997: 313).

The Bronze Age site of Gourlaw is located outside of Edinburgh, Scotland. A small collection of cremated remains were discovered within a collared urn from a burial cairn at this site and similar with other sites mentioned previously, this cremation assemblage also contains fragments which exhibit signs of degenerative disc disease. McSweeney discusses how four of the vertebral centrums from the individual have Schmorl's nodes, small indentations which tend to occur as a result of the normal degenerative process or a traumatic event (McSweeney, 2007b: 4). She also reports that one of the fragments also exhibited vertebral osteophytosis, a condition associated with spinal degeneration (McSweeney, 2007b: 4-5).

From the site of Gorice in Slovenia, Šlaus discovered evidence of pathological conditions on two of the four individuals. Šlaus reports moderate osteoarthritis on the joints of the individual from Grave 4, but as previously mentioned, he does not included information regarding which specific joints that were affected. This individual also exhibited antemortem tooth loss, but again no details were mentioned as to which tooth was missing (Šlaus, 2010: 126). Grave 5 contains fragments with evidence showing antemortem tooth loss; however no further details regarding this condition were included (Šlaus, 2010: 126).

In 2003, Roberts analyzed the cremated remains recovered from an urn at the site of Glennan near Argyll and Bute in Scotland. She found that the remains (Roberts, 2003: 9). She discusses that the individual was suffering from mild degenerative disc disease and porotic hyperostosis, as evidenced by vertebral disc porosity, osteophytic growth on the spine, and cranial pitting (Roberts, 2003: 10). Roberts also mentions that both pathological cases were only in the early stages of manifestation and it is unlikely that the individual would have been debilitated by either condition (Roberts, 2003: 10).

McSweeney reports that the individual from the Bronze Age burial at Ratho exhibited large numbers of pathological lesions, mainly in the spine, hip joint, and feet. She suggests rheumatoid arthritis, psoriatic arthritis, or ankylosing spondylitis as possible explanations for the lesions (McSweeney, 1995: 84). When the weight of the cremated bone assemblage is taken into account (over 2000 grams), it is not overly surprising that multiple lesions were found on the skeleton. With larger collections, it is more likely that fragments exhibiting pathological conditions will be included in the assemblage.

Within the Scottish collection analyzed by the author, there was only one cremation assemblage (Easter Gellybank) out of the six sets of remains that exhibited any signs of pathological lesions. There was slight osteophytic growth on the centrum of one of the vertebral centrums, indicating spinal degeneration; however due to the condition of the fragment, the specific vertebra was not identified. The identification of a pathological abnormality from Easter Gellybank may be partially due to the large collection of remains present. With the other five assemblages, the lack of pathological lesions may be due to the small amount of bones collected for burial. If only small assemblages are collected, then the chance of diseased or abnormal bone fragments being selected is minimal.

At Békásmegyer, 18 graves were discovered to contain bone fragments which exhibited pathological conditions. Eleven individuals were found to exhibit lesions which Heußner attributes to severe metabolic conditions (2010: 311). Three individuals had bone fragments with areas of damage and inflammation, likely due a traumatic event and four individuals exhibited antemortem tooth loss (Heußner, 2010: 311). Heußner reports that dental conditions such as caries and periodontal disease were only identified sporadically, due to the poor preservation of the teeth and jaw material (2010: 312).

At the Slovenian site of Tolmin, the authors found that although the collection lacked a significant amount of pathological lesions in relation to its size, several long bone shaft fragments were discovered with slight periostitis. Ravedoni and Cattaneo report that the lesions, caused by an inflammatory process of the periosteal bone, may be a consequence of several factors, with the most likely being due to an occurrence of trauma (Ravedoni & Cattaneo, 2002: 119).

The low frequency of pathological lesions discovered from the studied assemblage of Slovenian remains is not unexpected due to the small amounts of bone collected for burial. Owing to the incomplete nature of each cremation, it is unlikely that the specific bone areas that exhibited the pathological lesion would have been included in the urn. Firing, post-cremation handling, and excavation damage can cause fragments with lesions to become further fragmented, increasing the difficulty of accurate identification by the osteologist.

As mentioned in Chapter 4, problems arise when attempting to assign a 'diagnosis' to an individual as diseases can cause the same symptoms to appear on the bone. Unless the full range of symptoms is present, all of the likely infectious causes must be considered. It is uncommon for an entire individual to be included in a cremation burial; this increases the chances that bones with potential lesions or fractures may be left out. With only a small portion of the examined Slovenian skeletal remains having been collected from each individual, it is nearly impossible to provide an accurate diagnosis and only speculation can be made. However, it is important to keep in mind that even with complete and well-preserved skeletons difficulties can occur while interpreting pathological lesions and that it is still possible for cremated remains to provide information regarding health and disease in ancient populations.

6.5 Temperature of Firing

As discussed in Chapter 2, the coloration of cremated bones directly reflects the temperatures in which the fragments were fired. It has been generally accepted that by analyzing the color of the bone, the approximate temperatures of firing can be ascertained. Several studies have been performed by various researchers such as Mays, Shipman et al., and McCutcheon, which have helped to establish a generalized trend in increasing temperatures of firing and associated color changes. From the multiple studies conducted, it is generally accepted that there is a gradual change in color from the tan and light brown of unburned bone at approximately 200-300°C to a darker brown to charred black as temperatures exceeds 300°C. Blue and grey coloring generally reflects temperatures of between 500°C and 645°C; constant exposure to temperatures over 645°C result in calcined or fully oxidized bone ranging in color from buff to white to light grey.

As shown in Chapter 5, the Slovenian cremated remains under study exhibit low temperatures of burning, mainly between 200-500°C, with individuals from Brinjeva gora being burned at slightly higher temperatures than at Ruše and Pobrežje (Figure 16).

Figure 16. Cremation assemblage showing light degree of burning.

The temperature of burning associated with the Slovenian Urnfield Culture remains is surprising low in comparison with cremated remains from other cemetery sites. Table 23 shows the range of firing for the cremation assemblages from these sites.

Site/Location	Time Period	Temperatures	Reference
Spong Hill, England	Anglo-Saxon	>645°C	McKinley, 1994
Hohokam sites, United States	Hohokam	500-645°C	Merbs, 1967
Ranch Ruin/Wind Mountain	Late Pithouse	645°C	Creel, 1989
Békásmegyer, Hungary	Late Bronze Age	500°C to >645°C	Heußner, 2010
Tolmin, Slovenia	Late Bronze Age	>645°C	Ravedoni & Cattaneo, 2002
Westhampnett, England	Iron Age	>1000°C	McKinley, 1997a
Perry Oaks, England	Bronze Age	>1000°C	McKinley, 2006b
Beacon Wood Hill, England	Bronze Age	>1000°C	McKinley, 2008a
Castle Field, England	Bronze Age	>600°C	Western, 2006
Sketewan, Scotland	Bronze Age	>800°C	McSweeney, 1997
Mousland, Scotland	Bronze Age	>645°C	Downes, 1994
Loth Road, Scotland	Bronze Age	>800°C	Roberts, 2007
Easter Essendy, Scotland	Bronze Age	>645°C	McSweeney, 2007a
Rowallan Castle, Scotland	Bronze Age	>645°C	McSweeney, 2002
Skilmafilly, Scotland	Bronze Age	>645°C	McSweeney, 2001
Gourlaw, Scotland	Bronze Age	>645°C	McSweeney, 2007b
Glennan, Scotland	Bronze Age	>645°C	Roberts, 2003
Olcote, Scotland	Bronze Age	>645°C	McSweeney, 2005a
Farrochie Farm, Scotland	Bronze Age	500->645°C	McSweeney, 2005b
Ratho, Scotland	Bronze Age	500->645°C	McSweeney, 1995
Roman Road, England	Roman	>645°C	Western, 2005
Eastchurch, England	Romano-British	500->645°C	McKinley, 1999
Ruše, Slovenia	Late Bronze Age	200-300°C°	Thomas, 2010
Brinjeva gora, Slovenia	Late Bronze Age	200-500°C	Thomas, 2010
Pobrežje, Slovenia	Late Bronze Age	200-300°C	Thomas, 2010
Tolmin, Slovenia	Late Bronze Age	>645°C	Ravedoni & Cattaneo, 2002

Table 23. Temperature of Firing for various cemetery sites.

Site/Location	Time Period	Temperatures	Reference
Easter Gellybank, Scotland	Bronze Age	>645°C	Thomas, 2007a
Aberdeenshire, Scotland	Bronze Age	>645°C	Thomas, 2007b
Achnacreebeag, Scotland	Bronze Age	>645°C	Thomas, 2007c
Arran, Scotland	Bronze Age	200->645°C	Thomas, 2007f
Blairmore, Scotland	Bronze Age	200->645°C	Thomas, 2007d
Dunion Hill, Scotland	Bronze Age	200-300°C	Thomas, 2007e

Table 23 cont. Temperature of Firing for various cemetery sites.

At the Anglo-Saxon cemetery at Spong Hill, the majority of the remains are reported to have been thoroughly burned at high temperatures over 645°C with many bones reaching a high state of calcination. The firing from Spong Hill is similar to the temperature of firing reported for other cremation assemblages. At four Hokokam cremation sites in Arizona, United States, Merbs describes how the majority of the remains are considered to be "completely incinerated", with the majority of the bones being white, light grey, and blue in color, indicating high temperatures of 500-645°C (Merbs, 1967: 501). At other Native American sites in the Southwestern United States (Ranch Ruin and Wind Mountain), the cremated human remains are reported to have been burned similarly; the fragments are generally calcined white, grey, and blue in color, indicating high temperatures around 645°C (Creel, 1989: 313).

From the Late Bronze Age site of Békásmegyer from Budapest, the cremated remains from 248 individuals were analyzed. The remains were found to have been burned at a range of temperatures, from 500°C to over 645°C, as evidenced by the bones being black, yellow, and white in color (Heußner, 2010: 307). Microscopic analysis on the osteon structure of the bone revealed that the bones were burned at very high temperatures, but not exceeding 800°C (Heußner, 2010: 307).

As discussed in Chapter 3, at the Slovenian site of Tolmin, the remains were reported to have been primarily grey, with lower percentages of black and white (Ravedoni & Cattaneo, 2002: 116). Although the color of remains reveals that the bones were burned at higher temperatures, they also show that they have been burned at a variation of temperatures. As evidenced by the white coloration, it is clear that areas of the skeletons were burned at temperatures reaching over 645°.

McKinley reports the buff-white color of full oxidation and high temperatures over 1000°C from a large collection of cremated remains from the following sites: Westhampnett, an Iron Age site in West Sussex, England; Perry Oaks, a Bronze Age site in southern England; and Beacon Hill Wood, a Bronze Age site near Somerset in England (McKinley, 1997: 66; McKinley, 2006b: 2; McKinley, 2008a: 2). Calcined remains burned for an extended period of time at high temperatures over 600°C have been recorded from the Late Bronze Age site of Castle Field in Stapleton, England (Western, 2006: 8). From the large Bronze Age site of Sketewan in Scotland, the majority of the cremated bones are reported to be well-calcined from temperatures over 800°C, with bones on the periphery of the pyre having been burned at temperatures between 500-645°C and from the Bronze Age site of Mousland in Orkney, remains have been found to be completely calcined and burned at over 645°C (Downes, 1994: 146; McSweeney, 1997: 316; Roberts, 2007: 12). As with Sketewan, the bones from Loth Road in northern Scotland were found to be burned at temperatures exceeding 800°C; Roberts explains that this coloration indicates a sophisticated level of technology in terms of pyre construction and the overall cremation process (Roberts, 2007: 12). Other Scottish Bronze Age cremation sites such as Easter Essendy, Rowallan Castle, Skilmafilly, Gourlaw, Glennan, and Olcote show evidence of high burning over 645°C for extensive period of time (McSweeney, 2001: 25; McSweeney, 2002: 6; Roberts, 2003: 10; McSweeney, 2005a: 27; McSweeney, 2007a: 7; McSweeney, 2007b: 5).

From the site of Farrochie Farm in northern Scotland, McSweeney reports variation in burning on an assemblage of cremated remains with temperatures ranging from 500°C to over 645°C. This is a slight deviation from the normal firing patterns found on cremated remains from other Bronze Age Scottish sites, which were mentioned previously. The black coloration found on the remains shows that full oxidation of the remains and constant high temperatures were not achieved in all areas of the skeleton (McSweeney, 2005b: 4). While the extremities of the skeleton were completely burned, the center of the body remained burned at a lower degree of firing; this has been attributed to possible poor pyre construction or an insufficient duration of firing (McSweeney, 2005b: 4).

Similar burning patterns were found on a set of Bronze Age cremated remains from the multi-period site of Ratho in Scotland. McSweeney reports the primary color of the remains to be yellow-brown, although many of the bones, especially cranial fragments, were black, grey, or blue on the internal side (McSweeney, 1995: 83). She explains that this is indicative of uneven combustion of the skeleton, particularly of the skull and it is likely that the body had been placed in a supine position with the head furthest from the heat of the fire (McSweeney 1995: 83).

From the Roman Road site near Stretton Sugwas, Western reports that all three deposits of cremated bone material had been subject to complete oxidation and a sustained period of time (2005: 8). She discusses how many of the bone fragments exhibited a blue-grey coloration on the internal surface of the cortical bone and on the cancellous bone fragments, indicating that the remains may have been exposed to high temperatures long enough for oxidation to occur only on the external side of the bones (Western, 2005: 8). The presence of unburned bone from each deposit is also mentioned and Western states that a funerary event separate to the main cremation process may be the reason for such fragments (2005: 8).

At the multi-period site of Eastchurch on the Isle of Sheppay, three cremation deposits from the Romano-British period have been located within several small depressions. McKinley reports that the remains are mainly white in color, having been fully calcined, but there are several fragments which show slight blue and black colorations, due to a lower level of oxidization (McKinley, 1999: 12). Based on the analysis of each specific fragment which had been exposed to a lower degree of burning, McKinley was able to determine that the fragments were likely to be from the legs and/or arms; it is likely that the covering of the bones by the large limb muscles or grave goods would have prevented the full oxidization of the bones (McKinley, 1999: 2).

The Scottish cremation assemblages studied by the author tended to be burned at a range of temperatures, but mainly over 645°C. The remains from Easter Gellybank and Aberdeenshire are white with slight bluish-grey and black around the edges of some of the fragments, the bones having reached temperatures of up to 645°C. The remains from Achnacreebeag are completely calcined, indicating temperatures exceeding 645°C. The remains from Arran and Blairmore show a range of colors including tan, dark brown, black, grey, blue, and white, indicating varying temperatures from 200°C up to and over 645°C. The bones from Dunion Hill are light brown in color, having been burned between 200-300°C. The burning trend of the Scottish cremations is similar to that of the studied Slovenian cremations in that a wide range of colorations and temperatures are represented; however, the majority of the remains from Scotland were burned at high temperatures whereas the examined Slovenian bones were primarily burned at temperatures between 200-500°C.

As discussed previously in Chapter 2, variation in color across the skeletal remains tends to indicate uneven burning across the pyre and there are a number of factors and/or positions on the pyre that would have influenced the differential degrees of burning across each of the cremated individuals (see Chapter 2). The first potential cause of color variation may be attributed to the position in which the body was placed onto the pyre. There are several positions in which the body may have been laid out.

Robinson reports that the arms and legs of the deceased individuals in Aboriginal Australia were often bound together prior to cremation and occasionally placed in a sitting position on top of the pyre (Hiatt, 1969: 105). At modern Indian cremations, the body is placed on its back with the arms and legs extended. In the Southwestern United States, a cremation assemblage is reported to reflect differential burning due to collapse of the funerary pyre, which caused the body to shift onto one side (Creel, 1989: 313). At the site of Sketewan in Strathtay, Scotland, the bodies were fully extended on the pyre with the arms stretching out to the sides or over the head (Mercer & Midgley, 1997: 289).

As discussed previously, McSweeney's 2002 report on the Rowallan Castle cremation, the remains described as being beige with areas of dark blue-grey and white.

The variation in color found on these bones indicates an uneven burning of the body, particularly on the skull, long bones, and spine (McSweeney, 2002: 7). McSweeney discusses how based on the firing patterns visible on the bones, the spine would have been at the periphery of the fire as the body was burned on one side (McSweeney, 2002: 7).

At Spong Hill in England, although the majority of the bones were found to be completely oxidized, many of the fragments from each assemblage exhibited a range of colors. Bones such as the lower leg and feet, portions of the vertebrae, and the hand bones were often found to be incompletely oxidized, being black, grey, blue, or brown in color (McKinley, 1994b: 83). This pattern of burning was likely due to the bones being placed nearer to the periphery of the fire where the temperatures were lower. It is also possible that bones such as the pelvis and the femur would have been insulated from the high temperatures by the muscles and ligaments of the buttocks and the thigh and would not have burned as well as other parts of the body.

McKinley reports that the individuals would have had to have been placed supine and extended on the pyre based on the degree of burning noted and the location of grave goods which had fused to the remains (McKinley, 1994b: 84). She found that with many of the bodies, the dorsal side of the vertebrae were incompletely burned, suggesting that the backside of the individual was placed against the pyre or bier (McKinley, 1994b: 83) She explains that the grave goods must have remained in place long enough throughout the cremation to have fused onto the bones during cooling; movement of the body or placement in a prone or sitting position would have prevented fusion (McKinley, 1994b: 83-84).

One would expect from individuals placed supine or extended during firing that the hands and feet would have been poorly fired if they were on the periphery of the pyre. If the arms were crossed over the body, then they would have been exposed to higher temperatures than on the edge; however areas of the body will little soft tissue will not cremate as fully as other areas of the skeleton (McKinley, 1994b: 83). Such areas include the hands and feet.

The large quantity of remains recovered from each cremation at Spong Hill allowed McKinley to theorize on the likely position of the body of each individual. From the Slovenian cremations analyzed by the author, such a presumption was not achievable. The burning patterns on the Slovenian bones under study did not reveal an apparent trend in one area of the body being differentially burned than others; however this may be directly related to the small amount collected for burial. Without the entire skeleton, the degree of burning of each skeletal area cannot be ascertained. It is assumed that with each cremation, bones in the center of the fire would have burned at a higher temperature than those on the periphery, however as the exact placement of the body in the pyre cannot be known. It is assumed that the individuals from the studied Slovenian cremations were placed supine on the top of the pyre in order to facilitate adequate burning; however due to the small amount of bone fragments collected burning patterns could not be identified and specific placement on the funerary pyre could not be verified. Placing the body on the ground would not have achieved a substantial degree of burning, as there would have been an inadequate source of oxygen to various areas of the corpse. It is also not possible to know the exact maximum temperatures reached; as evidenced by areas of calcination, it is clear that the fires reached 645°C in some cases; however fires may have reached even higher temperatures.

It would be difficult to determine the initial position of the body if the burning patterns on the remains reflected the position of the skeleton after collapse of the pyre or movement of the bones by funerary attendants. During cremation, it is not uncommon for the bones to be raked or stirred, which would move the fragments from their original position. Movement of the remains across the pyre would cause differential burning patterns as some bone fragments would be moved closer to the heat, and therefore exposed to higher temperatures.

It could be argued that Late Bronze people in Slovenia did not possess the knowledge of achieving and maintaining high firing temperatures. This is highly unlikely given the evidence for advanced metallurgical activities at that time. Individuals practicing sophisticated bronze and iron metallurgy must have known how to create temperatures high enough to melt copper and iron, which have melting points of 1084°C and1540°C, respectively (Renfrew & Bahn, 2004: 348, 355).

The reason behind the low burning of the remains is unknown; however it may have been related to ritualistic purposes. If the remains were burned at low temperatures, it is likely that they were left on the pyre for a longer period of time; pyres burning at such temperatures would have taken longer to completely remove the flesh from the skeleton. After the skeletal remains were clear of tissue, it appears that firing process was stopped or allowed to burn out, thus explaining the light brown coloring of most of the remains. With only small amounts of bone being collected for burial, it is possible that mourners would have wanted to preserve large fragments of the skeleton for distribution throughout the community. Burning at high temperatures for varying periods of time would have reduced the remains to small, unidentifiable fragments and it may have been important for certain elements to retain their structure to be allocation or use in other ritual ceremonies.

Currently, no evidence has been discovered from the Slovenian remains from this study which would provide details regarding pyre construction. No pyre sites have been discovered in the Styrian region of Slovenia and there are several reasons which must be considered regarding this fact. It is likely that the pyre sites have not yet been uncovered. It is possible that the pyre sites may have been located away from the cemetery or the settlements or perhaps built in an area of the cemetery which has not yet been excavated. Further excavations in the areas around the cemeteries and settlements may result in the discovery of such sites.

Experiments performed by various researchers have shown that a burned pyre leaves only a several centimeter deep impression in the earth (J. McKinley, personal communication, October 2009; A. Sheridan, personal communication, October 2009). McKinley reports that pyre sites are generally built on flat ground and the heat of the pyre will only penetrate up to 10 cm into the ground, therefore being highly susceptible to destruction by erosion, plough damage, or excavation (McKinley, 2008c: 171). It may be that the pyre sites from Slovenia have been destroyed by farming activities or altogether missed during excavation if they were only a few centimeters into the ground.

6.6 Fracture Patterns

In Chapter II, varying types of fracture patterns that occur when bone is exposed to heat and fire are discussed. Mays (1998: 207) suggested that fragmentation and distortion of burned bone is the result of rapid water loss during the process of cremation, although Ubelaker has suggested that splintering and warping may be due to burning of the body immediately after death (Ubelaker, 1978: 35). It is generally accepted that bones burned without flesh exhibit superficial "checking" or "patina" style fracturing with longitudinal fracturing and no warping or twisting. Green or fleshed bones generally exhibit deep longitudinal and spiral cracks with serrated transverse fracturing; however, green bones tend to exhibit cortical exfoliation more frequently than fleshed bones, which tend to show u-shaped fractures and fissuring along curvilinear planes.

As discussed in Chapter 5, the cremated remains from all three sites in this study have been subjected to a high level of warping, twisting, longitudinal cracking, serrated diagonal fracturing, and curved lateral and transverse splintering; this type of fracturing is consistent with remains burned with the flesh attached. The exact treatment of the Slovenian bones after firing cannot be known; however, contact with cold fluids or other materials after or during the cremation would have caused further fracturing of the remains. In certain instances, Roman cremations were quickly doused in the sea after only being half-burned, and then buried in order to speed up the burial process (Noy, 2000: 190). Perfumes were also thrown into the flames during the cremation (Nock, 1932: 332). Water and/or wine was sometimes thrown onto the pyres to aid cooling; this would have caused further fragmentation and splintering of small cracks and fissures (McKinley, 1994a: 340; McKinley, 1994b: 86; Williams, 2004a: 278). Cremation pyres may have also been extinguished using milk or sand (Wahl cited in McKinley, 1994b: 86).

Cremated bones are extremely fragile and post-firing treatments can also cause further fragmentation. The remains are often stirred to aid the cooling process which would have caused additional splintering. After firing, the Slovenian remains from this study may have been stirred and were collected from the pyre and placed into urns; this extra handling would have further contributed to the fragmentation of the already fractured remains.

6.7 Cremation weights

In comparison with other studies on cremation weights, the weights of the cremated remains from the three assessed Slovenian sites is low (ranging from 1.1 grams to 573.7 per individual), even allowing for the fact that several assemblages contain the remains of an infant. From McKinley's (1993) analysis of 15 modern cremations, she estimated a range of 1001.5-2422 grams per adult individual with an average of 1625.9 grams for cremated remains from an archaeological setting (McKinley, 1993: 284). This range averaged the weight ranges for both males and females; males ranged from 1735.3-3001.3 grams with an average of 2226.2 grams and females ranged from 1227.4-2216.0 grams and an average weight of 1615.7 grams (McKinley, 1993: 285). From an additional analysis of the same material, she also reports a range between 1600-3600 grams for a modern adult cremation, with the average of 3000 grams or approximately the same weight as a dry-bone skeleton (McKinley, 1989: 66). McKinley did not include weight ranges for juveniles, but the cremated weight of an adolescent would be less than that of an adult. She mentions that the difference in weights is due to the presence of < 2 mm fragments being included in the weight category for the modern cremations in comparison with the archaeological cremations, where the < 2 mm would have been excluded from the weights collected.

As McKinley mentions, it is generally accepted that the individual cremations with smaller weights and larger degrees of fragmentation may be represent a female, due to the tendency of women to weigh less than men and the prevalence of osteoporosis. However, it can be argued that the weight of a cremation cannot accurately determine the sex of a cremated individual, as there will always be overlap in individuals' size and weights due to population variation. This is especially true when handling an extremely small cremation; in this instance, weight will reflect the amount of bones collected for burial rather than the size of the deceased individual.

One large problem with this study is the age range of individuals selected for analysis. Although McKinley recognizes the potential bias, individuals with the age range of 62-94 years are nevertheless used in this research. While it is not possible to know with exact certainty the potential implications of utilizing an older sample population, one must consider that the weights may be slightly smaller due to osteoporosis and bone degeneration in both males and females. It would also be desirable to evaluate the resulting weights of individuals ranging from 20-62 years, and also the weights of infant and juvenile remains in comparison with the weights collected from this study.

In another study, W. M. Bass and R. L. Jantz (2004) performed an analysis on sets of remains of 151 males and 155 females obtained from the East Tennessee Crematorium in order to investigate the variation in the weights of cremated remains. Weights were recorded at the East Tennessee Cremation Company in Marysville, Tennessee. Deceased individuals were placed into a casket or cardboard container and burned at temperatures ranging between 1600-1800°F; time of burning varied based on size of body and bone structure of each individual (Bass & Jantz, 2004: 1). After cooling, the remains were removed from the cremation chamber and a magnet was used to remove any coffin nails, screws, or staples present among the bone fragments. Remains were then passed through a cremulator, which turned the surviving bone fragments into ash or "cremains"; once the cremation process was complete, cremains were then weighed.

The authors found that the average weight of cremated remains for male individuals was over 3000 grams, with weights ranging from 1865 grams to 5379 grams; females averaged 2350 grams, with weights ranging from 1050 grams to 4000 grams (Bass & Jantz, 2004: 2). From the weights collected, they concluded that the sex of the individual plays an important factor in the weights of each cremated individual, with males being approximately 1000 grams heavier than women and females losing bone weight at almost twice the rate of males (Bass & Jantz, 2004: 2). After analyzing the sex of the individuals with their corresponding weight and age, the authors demonstrated that the weight of each individual declined significantly as age increased, with males losing 8.19 grams of bone weight per year as opposed to the 16.55 grams lost by females, which is thought to reflect the acceleration of bone loss associated with menopause (Bass & Jantz, 2004: 2-3).

While this data is informative and may be utilized as a general guideline to cremation weights, it should be noted that variation within a population will produce heavier females and lighter males. Caution should be taken in determining the sex of an individual based on weight alone, especially when working with a small cremation. Smaller weights may be a reflection of the age of the individual or more likely, specific selection of bones for burial.

Table 24 provides a list of various archaeological sites and the range of weights recovered from each individual within the cremation assemblages. Each assemblage will be discussed in further detail below.

Site/Location	Time Period	Number of cremation assemblages	Cremation weights (grams)	Reference
Spong Hill, England	Anglo-Saxon	2259	117.2 – 3105.1	McKinley, 1994
Perry Oaks, England	Bronze Age	2	284.0; 513.9	McKinley, 2006b
Beacon Wood Hill, England	Bronze Age	1	504.9	McKinley, 2008a
Mousland, Scotland	Bronze Age	1	555.1	Downes, 1994
Kavousi Vronda, Crete	Iron Age	3	9.0; 14.0; 19.0	Liston, 2007
Kenchreai, Greece	Roman	1	121.0	Ubelaker & Rife, 2007
Dobova, Slovenia	Late Bronze Age	60	4.0-360.0	Starè, 1975
Békásmegyer, Hungary	Late Bronze Age	248	>100.0-400.0	Heußner, 2010
Eastchurch, England	Romano-British	3	219.9; 229.9; 332.7	McKinley, 1999
Loth Road, Scotland	Bronze Age	1	13.8	Roberts, 2007
Castle Field, England	Bronze Age	1	5.8	Western, 2006

Table 24. Range of cremation weights from various archaeological sites.

Site/Location	Time Period	Number of cremation assemblages	Cremation weights (grams)	Reference
Olcote, Scotland	Bronze Age	1	158.0	McSweeney, 2005a
Sketewan, Scotland	Bronze Age	15	240.0 – 2060.0	McSweeney, 1997
Roman Road, England	Roman	3	80.6; 0.5; 112.8	Western, 2005
Bu Farm, Scotland	Bronze Age	2	60.0; 780.0	McSweeney, 1996
Easter Essendy, Scotland	Bronze Age	2	326.3; 760.9	McSweeney, 2007a
Farrochie Farm, Scotland	Bronze Age	1	497.0	McSweeney, 2005b
Linga Fiold, Scotland	Bronze Age	1	633.11	Wiggins, 1995
Rowallan Castle, Scotland	Bronze Age	1	1005.0	McSweeney, 2002
Arran High School, Scotland	Bronze Age	1	1908.0	McSweeney, 2006
Ratho, Scotland	Bronze Age	1	2063.0	McSweeney, 1995
Germany*	Urnfield Culture; La Tene; Roman	750	Averages: Urnfield Culture – 393.0; La Tene – 347.0; Roman – 317.0	Wahl, 2008
Aberdeenshire, Scotland	Bronze Age	1	239.91	Thomas, 2007b
Achnacreebeag, Scotland	Bronze Age	1	9.01	Thomas, 2007c
Arran, Scotland	Bronze Age	2	210.82	Thomas, 2007f
Blairmore, Scotland	Bronze Age	1	30.74	Thomas, 2007d
Dunion Hill, Scotland	Bronze Age	1	258.15	Thomas, 2007e
Easter Gellybank, Scotland	Bronze Age	3	1756.6	Thomas, 2007a

Table 24 cont. Range of cremation weights from various archaeological sites. *Information was taken from 75 unnamed sites.

The weights from Spong Hill range from 117.2 grams to 3105.1 grams. McKinley discusses how the varying recovery of the remains may have been dependent on the weather or social status of each deceased individual; poor conditions would have prohibited complete collection of the remains as mourners hurried to avoid prolonged exposure to the elements. With a socially higher ranking individual, more care and time may have been taken to ensure that the remains were collected properly (McKinley, 1994: 85).

From two collections of Bronze Age cremated remains collected from Perry Oaks in southern England, McKinley records total weights of 513.9 grams and 284.0 grams. While these weights are reported to be within the range observed from other cremation burials, McKinley discusses how they are below the average recorded weights and that the other remaining bone material must have been disposed of in another location (McKinley, 2006b: 2).

In southern England, 509.4 grams of cremated bone was recovered from the Bronze Age site of Beacon Wood Hill. McKinley reports that this assemblage only represents approximately 32% of the total weight expected from an adult cremation, but does fall within the median range for cremations recovered from the Bronze Age (McKinley, 2008a: 2). Similar weights were found at the Bronze Age site of Mousland in Scotland. Over 555 grams were recovered and Downes discusses how this assemblage represents only 36% of the weights expected from a fully cremated adult individual (Downes, 1994: 147).

At the site of Kavousi Vronda in eastern Crete, 97 Early Iron Age cremations were discovered in 19 cist graves; included in these cremations are what have been referred to as 'token deposits' (Liston, 2007: 58, 60). These remains comprise specifically selected remains, weighing less than 20 grams in total, that were placed in amphorae and were considered to be an adequate representation of the deceased (Liston, 2007: 58).

Another site which reveals specific collection is that of Kenchreai in Greece. This Roman Age site has revealed numerous tombs, in which both cremations and inhumations were discovered. In their interpretation of the remains from Kenchreai, Ubelaker & Rife (2007) discuss how a small collection of cremated bone found within one of the tombs directly reflects the mortuary procedure utilized by the mourners and suggests that the minute assemblages may have been sufficient to symbolize the individual at the burial site (49, 51).

As discussed in Chapter 3, 60 sets of cremated remains were analyzed from the Late Bronze Age site of Dobova in Slovenia. From this site, an array of weights was recovered, ranging from 4 grams to 360 grams (Starè, 1975: 19). While several of the assemblages weigh over 100 grams, the majority (78%) are less than that amount (Starè, 1975: 20). The collection of such small weights correlates with the findings from the three sites under study, as these sites produced very low collection weights.

From the Late Bronze Age site of Békásmegyer from Budapest, the cremated remains from 248 assemblages were analyzed. Several of the assemblages only contained a few fragments of burned bone; the remaining weights for the other 241 assemblages are as follows: 102 graves under 100 grams, 30 between 101-200 grams, 41 between 201-400 grams, and 68 cremations over 400 grams (Heußner, 2010: 307). The author reports that the presence of sand within the cremated assemblages made exact weights difficult to obtain.

From the Romano-British site of Eastchurch, McKinley analyzed the cremated remains from two graves, containing a total of three people. The weights from the three individuals were 219.9 grams, 222.9 grams, and 332.7 grams and McKinley reports that the maximum weight is only 20% of the expected weight from an adult cremation (McKinley, 1999: 12). She also discusses how the majority of the remains were within the 10 mm size range, the fragments not having been deliberately fragmented prior to burial (1999: 13).

Roberts explains that based on McKinley's 1993 study of cremation weights, the cremated bone weight from Loth Road of 13.8 grams represents less than 0.3% of the expected body weight for a cremated female individual (Roberts, 2007: 12). She further states that the incomplete bone material may represent a token deposit or the result of taphonomic factors such as wind, water, or post-depositional disturbance.

At Castle Field in Stapleton, England, a small assemblage was uncovered which resembles the small amount of bones from the site of Loth Road. This assemblage contained only 17.8 grams of fired bone material, and only 5.8 of the fragments being identifiable as human; it has been discussed that the content of the bone from Castle Field represents a maximum of approximately 1.2% of the expected amount of bone fragments from a cremated individual (Western, 2006: 4).

Similar results were found at the site of Olcote by McSweeney in 2005. Only 158 grams of cremated bone material were recovered from the grave and the associated cremation urn. McSweeney discusses how based on the amounts deemed by McKinley to represent a fully cremated skeleton, the remains from Olcote are clearly a small proportion of the deceased individual, She discusses how such a small assemblage is either the result of post-depositional erosion or an intentional token gesture; however it is possible that both factors may have attributed to the small assemblage size (McSweeney, 2005a: 26).

Several bone fragments from the Olcote bone material were found to be 55-65 mm in length; however the majority of the remains were 20 mm or less (McSweeney, 2005a: 25). It was unclear if the fragments had been deliberately crushed after firing but from the analysis of small bone fragments such as hand bones and teeth, it was apparent that the remains had been carefully hand collected from the pyre before burial (McSweeney, 2005a: 26).

At the site of Sketewan, token deposits have also been found with the weights from 15 cremation assemblages ranging from 240 grams to 2060 grams. McSweeney discusses how there is a direct correlation in the weight, sex, and age of the cremations and how the majority of the remains must have been carefully hand-collected from the pyre before burial, as evidenced by the presence of all skeletal elements in most burials and tiny bones such as hand phalanges (McSweeney, 1997: 316). She states that the larger cremations represent a nearly complete skeleton, whereas the smaller cremations represent token deposits (McSweeney, 1997: 316).

Deposits of cremated bone material were recovered from three irregular depressions found within an evaluation trench at Roman Road, near Stretton Sugwas in Herefordshire. The weights of the assemblages are 80.6 grams (Context 1008), 0.5 grams (Context 1010), and 112.8 grams (Context 1012). The remains from Context 1010 did not contain any fragments which could be accurately determined to be human. Western explains that the weights from Context 1008 and Context 1012 are a ‘maximum of approximately 10%’ of the amount expected from a completely cremated individual; this is extremely low especially considering animal remains were commingled in with the human bone (2005: 4).

Two cremations were discovered from two Bronze Age burial cairns at Bu Farm in Orkney. From the first cairn, the assemblage was comprised of only 68 fragments and 60 grams and from the second cairn 780 grams were recovered (McSweeney, 1996: 112). With the large difference in cremation weights, one might suggest that the bones were from one individual and dispersed between two burials. It is not discussed within the article whether or not the remains could possibly be from the same individual; however, McSweeney explains that the remains from Cairn 1 were burned dry and fleshless, some time after death (1996: 112), while the bones from cairn 2 were burned immediately after death (1996: 113).

At Easter Essendy Farm in Perthshire, Scotland, two cremation assemblages were discovered to contain small amounts of each individual, but these were not considered to be token deposits. Titled Cremation I, the first cremation contained approximately 326 grams of bone material and Cremation II contained just over 760 grams. McSweeney reports that limb bone fragments were underrepresented in each collection, and although this may contribute to the low percentages of bone material present, it is reasonable to infer that a portion of the remains were either lost post-depositionally or were just not collected for burial (McSweeney, 2007a: 5, 7-8).

Another Bronze Age Scottish site with a similar bone assemblage in terms of weight to Easter Essendy Farm is that of Farrochie Farm, near Stonehaven, Scotland. McSweeney reports 497 grams of cremated bone material with overall large fragment size and good preservation (McSweeney, 2005b: 2). Most skeletal areas were recorded as being underrepresented and it is clear based on the size of the cremation that it does not contain all of the fired skeleton (McSweeney, 2005b: 3). It is not discussed whether this assemblage could or could not be considered a token deposit; however, the small assemblage still may have been considered an adequate representation of the deceased for burial.

At the Bronze Age site of Linga Fiold in northern Scotland, 633.11 grams of cremated bone were recovered from the cist burial, the majority of the bones having been identified as human (Wiggins, 1995: 246). Wiggins discusses how the cremation falls within the 'single adult individual range'; however, as discussed previously, McKinley's determined weight ranges for a cremated individual are between 1600 and 3600 grams, indicating that the entire skeleton may not have been collected for burial (McKinley, 1989: 66; Wiggins, 1995: 246).

The remains from Rowallan Castle are represented by just over 1000 grams of bone material. McSweeney reports that, based on the amount present and the supposed bone weights established for cremated individuals by McKinley (1993), the bones may represent the full skeletal remains of a single individual (McSweeney, 2002: 4). This amount is larger than most Bronze Age cremations discovered in Scotland and almost double the amount of the largest cremation assemblage found in the Slovenian collection. She attributes the recovery of the large percentage of the skeleton to its position on the pyre, as the core of the body was likely to be on the periphery, away from the central part of the fire (McSweeney, 2002: 7).

In McSweeney's 2006 report on an assemblage of cremated remains from Arran High School, a Bronze Age site near Lamlash, Scotland, it was reported that 1908 grams of human bone material were recovered from one of the contexts. As with the cremation from Rowallan Castle, this assemblage is quite large in comparison to other cremations from Scotland and from Slovenia. Because it was larger in quantity with larger, better preserved fragments, McSweeney was able to perform a more detailed osteological assessment on this cremation and was able to discern age, sex, and several pathologies from the skeleton (2006: 6). She states that there was no indication of any deliberate fracturing of the remains after burning and that the majority, if not all, of the individual was collected for burial (McSweeney, 2006: 10).

As dicussed by McSweeney (1995), the Bronze Age assemblage from Ratho, Scotland was represented by 2063 grams of cremated human bone which were 'light, crumbly, and in generally poor condition' (1995: 80). However, this collection of bones comprises the nearly complete cremation of a single individual, rather than the remains of multiple individuals or a token deposit (McSweeney, 1995: 82), and it is surprising that an assemblage that is in such poor condition consists of such a large amount of bone material. It is likely that the urn in which the bones were found played an integral role in preserving the remains.

As discussed previously, a large study was compiled from a careful analysis of 750 sets of osteological remains from 75 funerary sites in southwestern Germany. Wahl reports that after careful analysis of a compiled osteological inventory, the average weight of cremations from the Urnfield Culture are 393 grams, the average for the La Tene period being 347 grams, and the Imperial Roman Period cremations being on average 317 grams (2008: 152). He discusses how the males were on average 30% heavier than females during the Urnfield Culture and 40% heavier in the La Tene period (Wahl, 2008: 152). Wahl does not include any details regarding which specific sites or individuals that were analyzed, but he does discuss how there may be a concealed social ranking within the cremation assemblages which may account for extremely large cremations and small assemblages from the same site (2008: 153).

As discussed above, only small assemblages were recovered for burial from each cremation urn at the three Slovenian LBA sites under study. It is possible that the small amounts of cremated bone placed in the urns may have been intended as token deposits, and therefore considered an adequate representation of the deceased within the cemetery sites. Within aboriginal communities in Australia, if the initial cremation did not destroy the corpse, the bones would be broken with sticks or reburned (Hiatt, 1969: 105). This method of further breaking down the remains is similar to that in recorded in ethnographic reports from Tasmania, where skeletal remains were smashed after burning (Jones, as quoted by Hiatt, 107). While the studied remains from Slovenia represent overall good preservation and large fragment size, it is likely that the fragments would have been in even better condition prior to handling and burial. It is likely that during and after firing, the bones would have been shifted on the pyre by attendants in order to facilitate burning and to move fragments on the periphery to the middle of the pyre where the temperature would have been higher.

This action would have caused further breakage of the remains and smaller overall fragment sizes. As evidenced by the small amounts collected for burial, it is likely that the bones were sorted through prior to selection, which would have also increased the degree of fragmentation of each cremation. This and post-excavation handling would have contributed to the overall fragmentation of the remains.

As discussed in Chapter 5, the Slovenian remains generally reflect an overall low collection amount per cremation and it is unlikely that weather conditions or social status would have influenced the amounts gathered for burial. Judging from small skeletal elements such as tooth roots, it appears time was taken by mourners to ensure specific selection of fragments for burial.

McKinley (1994b) also discusses the possibility of either winnowing or submersion in water to separate the remains from the grave goods, charcoal, or other materials included in the cremation. While both of these methods may have been used during the LBA in Slovenia to help facilitate separation, there is nothing that would indicate that either actually occurred.

Although there were several bone fragments over 60 mm from the analyzed Slovenian assemblages, the majority of the fragments were much smaller, around 30 mm. These measurements are much lower than those taken by McKinley in her analysis of modern cremations (1993: 284), where skull fragments were found to be over 95 mm and long bone fragments up to 195 mm. At Spong Hill, the average maximum fragment size was 42 mm, including the juvenile and infant remains which would have considerably lowered the average (McKinley, 1994b: 84). Although protected during burial by a cinerary urn, the fact that cremated remains are extremely friable and are susceptible to pre and post-depositional disintegration may explain the reason for such relatively diminutive fragment size within this assemblage.

With the Scottish assemblages, the amount of bone material collected per site is as follows: Aberdeenshire – 239.91 grams; Achnacreebeag – 9.01 grams; Arran – 210.82 grams; Blairmore – 30.74 grams; Dunion Hill – 258.15 grams; and Easter Gellybank – 1756.6 grams. Excluding the assemblage from Easter Gellybank, the remaining five assemblages represent only a small portion of the total body cremated. These cremation weights are similar to those collected for the Slovenian assemblages in that they may represent token deposits or an adequate representation of the deceased for burial. The large assemblage from Easter Gellybank consists of enough bone material to represent a cremated adult individual; however, there were three individuals recovered from this assemblage. Due to the presence of multiple individuals from this site, it is clear that only a fraction of each cremation was collected for deposition in the urn and the grave.

There are several ways which exist would explain the absence of large quantities of bone from the Slovenian remains from this study; such traditions have been documented from other cultures throughout the world which utilize the cremation process as their primary mortuary practice. In Aboriginal Australia, a man would wear the pulverized ashes of his wife in a satchel around his neck until he either remarried or the bag wore out (Dawson, 1881: 63; Hiatt, 1969: 108). As discussed in Chapter 2, teeth were often collected for ornamental use by family members (Howitt, 1904: 469; Roth, 1907: 388-389). In New Mexico, United States, ethnographic reports by Hammond and Rey discuss how cremated remains were offered to their idols instead of buried (as cited in Toulouse, 1944: 67). In India, the preferred Hindu funerary rite is cremation; after burning the ashes are scattered into the River Ganges (Oestigaard, 1999: 352). Within the Buddhist religion, bone and teeth fragments, especially of influential people, are considered to have ritual, commemorative, and protective significance and are reserved for distribution to members of the community (Crosby & Collett, 2005: 99).

It is also possible that the bones not collected for urn burial were actually buried elsewhere. Trench cremations were common among Native American tribes such as the Hohokam in the American Southwest, where the ashes are placed in long trenches rather than urns (Toulouse, 1944: 68). Another possibility is that the remains were distributed throughout the community to be consumed by close family members. In certain societies, the cremated remains of the deceased are considered to have apotropaic or amuletic functions and the consumption of the remains is included as a part of the funerary feast (Williams, 2008: 243). In the Yanomami tribes of South America, the deceased's burned remains are mixed with plantain juice and drunk by the closest family members at the funeral ceremonies (Tahan, 2002: 13).

It cannot be known what has occurred to the large amount of cremated bones from the three Slovenian sites which was not included in the urns or graves at the cemeteries. As no pyre sites or other large caches of burned remains have been discovered in eastern Slovenia, researchers are unable to verify if additional bones were left at the sites or moved to mass burial areas. It is possible that the large quantity of remains that were not collected for burial were either thrown into the nearby rivers or distributed within the community to close family members and friends, thus possibly explaining their absence from the archaeological record.

In Chapter 5, Table 17 shows the comparison of skeletal element survival across all three sites under study. As shown, the majority of the recovered fragments are cranial and long bone fragments. While this may reflect collection bias, both the cranium and long bones tend to survive cremation better than other areas of the body, which may explain why these body parts make up the majority of the bone assemblages. Aside from long bone and cranial fragments, the majority of the bones from the Slovenian collection comprise cortical bone, as opposed to cancellous bone. The fragments of spongy bone which did survive were largely unidentifiable fragments. There were no patellae or dental fragments recovered from Ruše and only certain cremations from Pobrežje contained any sternal or sacral elements.

As with the examined Slovenian remains, the majority of fragments identified from each Scottish assemblage were also skull and long bone fragments. Each site and its percentage of skull and long bone fragments are as follows: Aberdeenshire – 77%; Achnacreebeag – 77%; Arran – 96%; Blairmore – 99%; Dunion Hill – 69%; and Easter Gellybank – 58% (Table 25). It is likely that the recovery of these fragments is directly related to the fact that skull and long bone fragments are the most likely to survive firing and are also the most recognizable; however, it is possible that these fragments were specifically selected for placement in the urns.

From Spong Hill, McKinley reports that there was no indication of a deliberate bias in skeletal areas collected for burial and that the large quantity of skull fragments recovered may be attributed to the ease in identifying such fragments (1994b: 85). She also explains that the bones from Spong Hill were likely removed from the pyres in a similar way for each cremation. Each bone would have been removed individually as the collector moved across the pyre, brushing aside wood fragments and ash to expose small fragments such as the small hand and foot bones which were then collected (McKinley, 1994b: 85).

Site	Percentage
Aberdeenshire	77%
Achnacreebeag	77%
Arran	96%
Blairmore	99%
Dunion Hill	69%
Easter Gellybank	58%

Table 25. Percentage of skull and long bones from the Scottish cremation assemblages analyzed by the author.

At Perry Oaks in England, McKinley reports that from both major contextual assemblages, skeletal elements from all areas of the body were recorded. Although there is a low percentage of the axial skeleton present, McKinley attributes this fact to poor survival of the trabecular bone and states that there was no apparent bias in particular parts of the body having been specifically selected for burial (McKinley, 2006b: 3).

As with Perry Oaks, bones from all skeletal elements were recovered from Beacon Wood Hill, despite the assemblage representing only approximately 30% of the amount normally collected from an adult burial (McKinley, 2008a:2). McKinley discusses how fragments of the teeth, hands, and feet were well-represented; this may reflect a possible specific collection procedure to recover such small fragments for burial (McKinley, 2008a: 3).

At both Scottish Bronze Age sites of Loth Road and Olcote in northern Scotland, the majority of the cremated remains were long bone shaft fragments. Bones primarily comprised of cancellous bone such as the vertebrae and pelvis were not recovered as they are more susceptible to damage from firing and other taphonomic agents (McSweeney, 2005a: 26; Roberts, 2007: 12). Again, as discussed previously, it is most likely that the long bone fragments selected because of the ease associated with identifying them and their tendency to survive firing; however, it is possible that these fragments were selected specifically for a ritual or ceremonial purpose.

In the Pacific Islands, the first Lapita cremation was discovered at the Teourna cemetery near Vanuatu. This cremation assemblage is comprised of 620 grams and has been determined to contain the remains of one adult individual, although large portions of the skeleton are not represented within the collection (Scott et al., 2010: 904). The authors explain that the absence of various skeletal elements such as the skull, clavicles, and radii may have been due to specific removal procedures where the bones would be included in a different funerary ritual (Scott, et al. 2010: 907).

It was not possible to try and reconstruct the pattern in which mourners collected the Slovenian remains; however, it is reasonable that the bones were collected in the same manner discussed by McKinley. Multiple Slovenian assemblages contained tiny fragments such as hand phalanges and tooth roots, which would have fallen through to the base of the pyre and needed to be specifically hand-collected by the funerary attendants or mourners for deposition in the urn.

6.8 Animal Bones

According to Bond, the deposition of animals on a cremation pyre and the placement of the remains into the urn is a ritual act which provides information regarding past human-animal relationships within a specific society (Bond, 1996: 79). As shown in Chapter 5, both domestic (cattle, sheep, goat, pig) and wild (red deer, stone marten) animals were burned and the remains incorporated into the urn with the human bones. Not only does the discovery of cremated animal bones in association with burned human remains provide important insights into the rituals surrounding the treatment and burial of the deceased, it provides an indication of social status for the individual and possibly the extent of the animals' value within a community or society (Bond, 1996: 79).

During the osteological analysis, cremated animal bones were recovered from all three sites which are presumed to have been burned on the cremation pyre with the deceased individual and selected for placement in the urn and subsequent burial. It is often difficult to determine animal remains from human bones, owing to the small fragment sizes and the lack of diagnostic features which would help in specific identification; as a result it is likely that several animal long bone fragments were overlooked and therefore excluded from the archaeozoological analysis.

When performing an osteological analysis, it can be difficult to ascertain information regarding whether the animal bones were burned as food offerings for the dead or as the refuse from food eaten during a ceremonial feast. Bones may have served a totemic function, having been placed on the pyre in the form of skins, tokens, or charms (Bond & Worley, 2006: 89). Animals have also been included in cremation rituals as expiatory sacrifices which symbolize the wealth and status of an individual, a mode of transport which helps to carry the deceased into the afterlife, and personal companions or spiritual guides. It is important to take into account the fact that for certain cremation rites, an adequate amount of fuel would have had to been available for use. It is unlikely that a cremation pyre was constructed which could hold both a human corpse and an entire cow or horse. Although the animal may have been placed alongside the pyre with the human individual, this method does not ensure effective and complete burning. One must consider the possibility that multiple pyres would have been built to accommodate the larger animals, although this is unlikely as well. It seems more probable that certain skeletal elements or portions of the animal were selected for burning along with the human remains.

As with human bones, different skeletal elements of animals survive burning with varying degrees of fragmentation. The smaller the fragments collected, the more difficult it would be for an identification of species to be obtained. If specific species can be recognized, this information may be used in correlation with other discovered artifacts: in many societies, animals are incorporated into paintings, jewelry, or pottery designs which may provide further insight into potential human-animal interactions. It would also be advantageous to compare the grave goods found with the burials with animal bones which may give an indication of warrior status, or a wealthy individual.

It is important to recognize the incorporation of animal remains within cremation burials throughout the world. Table 26 provides a list of the animal remains recovered from the studied Slovenian cremation burials and from worldwide cremation sites.

Site/Location	Time Period	Animal Remains	Reference
West Point, Tasmania, Australia	Aboriginal	Hawk claws, duck bills, wallaby feet	Hiatt, 1969
Klungerhaugen, Norway	Merovingian	Horse teeth	Oestigaard, 1999
Tiel-Passewaaij, Netherlands	Roman	Chicken, horse, pig, goose, cattle, sheep, goat	Groot, 1994
Glennan, Scotland	Bronze Age	Goat/sheep	Roberts, 2003
Castle Field, England	Bronze Age	Unidentified mammals	Western, 2006
Bu Farm, Scotland	Bronze Age	Mammals, birds, fish	O'Sullivan, 1996
Roman Road, England	Roman	Goat/sheep, dog, bird	Western, 2005
Gorice, Slovenia	Late Bronze Age	Red deer	Šlaus, 2010
Békásmegyer, Hungary	Late Bronze Age	Sheep/goat; unidentified mammals	Heußner, 2010
Spong Hill, England	Anglo-Saxon	Cattle, dog, sheep, fox, fish	McKinley, 1994
Ruše, Slovenia	Late Bronze Age	Unidentified mammals	Thomas, 2010
Brinjeva gora, Slovenia	Late Bronze Age	Cow, sheep/goat	Thomas, 2010
Pobrežje, Slovenia	Late Bronze Age	Sheep/goat, red deer, pig, marten	Thomas, 2010

Table 26. Animal remains recovered from the three Slovenian sites under study and other worldwide cremation sites.

In Australia, hawk claws, duck bills, and wallaby feet have been found, presumed to have been relics of the dead (Hiatt, 1969: 108). In Norway, horse teeth have been discovered to have been placed with cremated human remains (Oestigaard, 1999: 355). The site of Tiel-Passewaaij in the Netherlands includes chicken, horse, pig, goose, cattle, and sheep and/or goat; the bones from this Roman site have been interpreted as ritual offerings, the remnants of a ceremonial meal, or sacrificial gifts (Groot, 1994: 182).

At the Scottish site of Glennan, the remains of a juvenile goat/sheep have been recovered which were burned with the individual on the pyre. Roberts discusses how fine transverse lines found on the shaft of a tibia may have been attributed to the skinning of the animal prior to burning (Roberts, 2003: 9). She also mentions how both the human and animal remains were possibly washed and then mixed prior to burial (Roberts, 2003: 10).

In the small cremation assemblage from Castle Field at Stapleton, England, Western reports the presence of both animal and human remains mixed together after firing. She emphasizes the importance of analyzing all fired remains, as they provide information regarding the collection and ritualized deposition of bone after the cremation process (Western, 2006: 3). Western also suggests that the incorporation of small mammal bones with the human remains indicates that the cremation ritual at Castle Field involved the deliberate inclusion of animals, possibly as a food offering or the remnants of a funerary feast (Western, 2006: 9).

At the site of Bu Farm in northern Scotland, one of the burial cairns containing cremated human remains also contained the faunal remains of mammals, birds, and fish. The author explains that although these remains were not burned as part of a cremation ritual, they may have been deliberately deposited prior to cist construction (O'Sullivan, 1996: 114).

An assemblage of cremated remains was recovered from three deposits during a trench excavation at the site of Roman Road near Stretton Sugwas in Herefordshire in 2005. Among the human bones, the remains of a goat or sheep, a dog, and a bird were discovered, with several fragments exhibiting perimortem chop marks and cut marks (Western, 2005: 9). Western discusses how the meat was removed from the bones before they were placed onto the pyre and these bones were likely to represent either the remains from a funerary feast or a food offering (Western, 2005: 10).

At the Late Bronze Age site of Gorice in Slovenia, one of the five excavated graves contained only the burned remains of a red deer. The remains are reported to have been well-preserved and robust in nature (Šlaus, 2008: 125). None of the bones exhibited cut marks or any signs of processing for funerary rituals or consumption (Šlaus, 2008: 125).

From Békásmegyer, several graves were found to include several fragments of animal bones; however two graves contained solely animal remains (Heußner, 2010: 313). From Grave 130, the postcranial remains of either a sheep or goat were recovered and from Grave 314, only unidentifiable animal long bone fragments were found (Heußner, 2010: 313). Heußner discusses how the presence of animal bones found exclusively within two separate pits and commingled in the human burials must be viewed as being specifically related to the funeral industry and burial customs (2010: 313).

As discussed by McKinley, at Spong Hill over 43% of the cremations contained animal bone and of those 1019 cremations, both domesticated and non-domesticated animals such as cattle, dog, sheep, fox, and fish have been recovered (1994b: 92). Several of the animal remains were recovered as accessory objects made of animal bone such as combs, stamps, and playing pieces. McKinley explains that the remaining animal bones may have been included in the funerary rituals as a food or votive offerings, a symbol of personal possession, or for amuletic significance.

Owing to the fragmentary and diminutive nature of the animal bones from the three Slovenian sites under study, it has not been possible to determine whether the fragments are from the entire animal being placed on the pyre, whether the bones were a part of a ritualized food or status offering, or whether they were accidental inclusions. None of the animal bones recovered were determined to have been part of animal accessory objects and no cut marks were found on the bones which would be indicative of meat being removed from the bones for the cremation ritual or dismemberment prior to burning (Bond, 1996: 82). It has also not been possible to determine whether the animal bones were burned as refuse after the meat was consumed by individuals attending a ceremonial feast.

It is unlikely that the animal remains were accidentally included in the cremations. The coloration of the animal bones remains is consistent with that of the human remains; this indicates that both the deceased and the animal were burned at the same temperatures and most likely on the same pyre with both the human and animal remains having been collected after firing. It is assumed, especially when referring to large animals such as cattle, that the individuals collecting bone for burial would have been able to recognize the animal skeleton as opposed to the human remains when selecting fragments. It is possible, however, that the animals and humans were burned separately on different pyres and that the bones were later mixed in the same cinerary urn. As mentioned previously in discussing overall cremation weights, it is important to note that if the amount of cremated bone extracted from the pyre and placed into the urn was intended as a token deposit, collecting the burned animal remains with the human bones would have been an intentional aspect of the burial ritual and the small amounts considered adequate for burial.

6.9 Cremation in Slovenia during the LBA

After the thorough examination of the results, the information has been organized so that it may be incorporated into the framework and context of Slovenian archaeology during the Late Bronze Age. A contextual overview is provided below.

Upon the death of an individual, members of the community would have gathered wood to create the funerary pyre. McKinley reports that in her experimental cremations, between 700 grams and 900 grams are commonly used to build the pyre (McKinley, 2008c: 168). Oak (*Quercus sp*), ash (*Fraxinus sp*) and/or alder (*Alnus sp*) would have been used, as these are the types of wood found from other cremation pyres in eastern Slovenia (Djurić, 2010: 34). The pyres may have been constructed with the wood being stacked in alternate layers, which would have provided adequate oxygen and heat transfer during the firing process. The size of the pyre may have been specific to the deceased individual, as it would have reflected social status and provided for a more flamboyant funeral. It is likely that the pyre sites were located near the small village settlements; however they did not need to be constructed close from the cemeteries as the bones could have easily been transported there in the cinerary urns after the funerary ceremony.

The body may have been placed into a wooden chamber for an extended period of time while the ceremony preparations were made. Garments may have been made specifically for the deceased and on the day of cremation, the body may have been dressed and placed whole and articulated on the top of the pyre. The arms and legs of the deceased may have been placed in certain positions such as the arms or hands being folded across the chest. For certain individuals of a specific social status, jewelry, ceramics, beads, food, incense, perfume, flowers, oils, amuletic objects, weaponry, and/or decorative fibulae may have been placed on the body as well. During this time, mourners may have celebrated with feasting and music.

The pyre may have been lit by a close relative of the deceased and pyre goods may have been added as burning commenced. The body was then burned for a short period of time at low temperatures, although many bodies may have been left on the pyres for longer periods of time as the temperatures increased. Additional fuel would have been added to the pyre during the burning process to maintain a high degree of burning. Oxygen levels would have had to be monitored, as a depletion in oxygen would have curtailed the cremation process and resulted in charring rather than burning (McKinley, 2008c: 165). External factors such as strong winds and unexpected rainfall would have had to be accommodated for, by using more fuel and consistently caring for the pyre.

The pyre would have gradually collapsed after about 2 hours, and it is likely that the bones were raked during burning as a uniform temperature could not have been maintained across the pyre during the entire cremation process (McKinley, 2008c: 167); this would have allowed for adequate air flow and complete consumption of the remains. Animals were occasionally burned, their remains being fired at the same temperatures as the humans and possibly on or alongside the same pyre. These remains may have been part of a ritualized food or status offering or may have been included as a totemic amulet, mode of transport into the afterlife, and or personal and spiritual companions.

At the end of the burning process, it is possible that liquids such as milk, wine, perfume, or water were added to either cool the remains or for ceremonial purposes. The remains would have been left for a period of time to allow for cooling. After cooling and the burning of the pyre, a small amount of fragments were selected from the pyre which would have been on the upper levels of the pyre debris commingled with the fuel ash (McKinley, 1997b: 137). This would have taken considerable time and effort as intentional efforts were made to carefully extract certain fragments from the burned material; small fragments such as tooth roots and tiny finger bones were often collected either by hand or possibly with tongs. Skull and long bones may have been selected intentionally from the pyre for burial for ritual purposes or they may have been chosen simply because they were the most recognizable fragments and those which survived burning. It is unknown why such time was taken to select only a small portion of the cremated remains; however, the small assemblages of collected bone material may have adequately represented the dead.

Bones which were collected were placed into a cinerary urn; these urns were generally large and globular vessels with decorative or painted surfaces. The urns were then buried in pit graves or the bones would have been placed alongside the urn within the grave. Grave goods such as pottery and bronze objects were then placed into the urn or next to the remains. It is possible that organic materials such as textiles, skins, fabrics, or wooden objects may have been placed into the grave; although none of such grave goods have been discovered, it is likely they would have disintegrated long before discovery. Large quantities of such goods may have placed into the graves of the individuals who belonged to the upper echelons of the society or community.

It is unknown what transpired with the remaining proportion of the remains which were not selected for burial. Bones may have been buried in another location near the settlement which has yet to be uncovered or the fragments may have been redistributed through the community. It is possible that some of the remains were placed into the nearby river, made into talisman items, or consumed by mourners.

The demographic profile supports the idea that members of the community of all ages were buried at the cemeteries; however, younger individuals may have been buried elsewhere as only a small percentage of the remains recovered could be classified as juvenile. Bias or organization of any of the cemeteries in regards to the sex of the individuals cannot be discussed as there is not enough evidence present to establish such a supposition. As there were no multiple burials, it was not possible to infer as to whether certain graves were used as ‘family’ graves. It has not possible to determine the population size for any of these sites due to many of the originally discovered cremation assemblages having been lost or destroyed since excavation. It would appear that several generations of individuals were buried at the respective cemeteries from each community; however radiocarbon dating and additional research would help to further define the phasing of each site.

CHAPTER VII

CONCLUSIONS

The resulting data from the osteological analysis of the remains from the three Late Bronze Age sites has provided important information regarding demographics and burial practices for eastern Slovenia during the Urnfield Culture period. To conclude this research, it is important that an overall review be included regarding the treatment and subsequent burning of the deceased from the three studied Late Bronze Age sites from eastern Slovenia.

The remains were in good condition when they were brought to the University of Ljubljana. There was no reason to believe that any of the assemblages contained two or more individuals and each labeled envelope was treated as a separate burial. Keeping this in mind, 169 individuals were analyzed for this research from Ruše, Brinjeva gora, and Pobrežje.

The determination of age was based on cranial thickness, bone morphology, dental development, and epiphyseal fusion. An estimation of age was determined for 123 individuals or 73%. This percentage is substantially lower than other cremation studies, but can be explained by the small amounts of bone collected from each grave. Very few juvenile individuals were recovered which is in contrast with general infant mortality trends of ancient populations. It is possible that juvenile remains were buried in other areas of the cemeteries or may have been treated in a different funerary manner. It is also possible that excavation and recovery techniques may be responsible for the limited volume of remains recovered, as small fragments may not have survived or were discarded. Due to the age determinations being mainly limited to broad categories, an average age at death for the individuals was not obtainable and no bias could be identified from one particular age group being buried in the cemeteries.

A determination of sex was only established for eight individuals. From Ruše, there was one male individual and two females. From Brinjeva gora, there was only one individual who was queried to be female and from Pobrežje, there were three males and one female. The low number of identified males and females was directly related to the lack of bones present within each cremation which exhibited sexually dimorphic characteristics. Due to the low percentage, sexual distributions or bias between sites was not attempted, as the results would have been meaningless.

Two pathological conditions were discovered on the bones of nine individuals; two of the cases were due to joint disease, the remaining seven from a metabolic disease. The two individuals with joint disease exhibited osteophytic growth on the margins of the vertebral bodies which is indicative of spinal degeneration. It is likely that the osteophytoses are due to spinal degeneration; however, there may be other pathological conditions which may have attributed to the additional growth and so a diagnosis could only be speculated.

The other seven individuals exhibited evidence of porotic hyperostosis. There are several possible etiologies for porotic hyperostosis, including rickets, scurvy, syphilis, and varying forms of anemia. Until very recently, the primary cause of porotic hyperostosis was considered to be iron-deficiency anemia or thalassemia. A recent study has discussed unfeasibility of iron-deficiency anemia to be the cause of porotic hyperostosis and has contended that nutrient-deficiency conditions and hereditary hemolytic anemias are more likely the causing factor. From each individual, there were only several small fragments which exhibited cranial pitting. Without the full skeleton, it was impossible to establish which disease is responsible for the cranial pitting, although it can be established that these individuals suffered from a metabolic disease, likely a nutritional deficiency or a form of megaloblastic anemia.

The low percentage of individuals exhibiting signs of pathological lesions from the studied Slovenian remains is not unexpected due to the low amount of bone fragments recovered from each grave. It is possible that several of the individuals may have suffered from a disease, but owing to the incomplete nature of each assemblage, the fragments with visible bony changes may have not been included. Other factors such as firing, post-cremation handling, and post-excavation treatment may have also damaged diseased fragments which would have increased the difficulty of accurately identifying lesions.

The cremated remains exhibit low temperatures of burning, mainly between 200-500°C, with individuals Brinjeva gora being burned at slightly higher temperatures than at Ruše and Pobrežje. Despite the overall low degree of firing at each site, it is clear that certain areas of the pyre reached hotter temperatures as shown by small calcined fragments recovered from each site. This low degree of firing contrasts with cremated remains from other cemetery sites around the world which tended to be completely calcinated and burned at temperatures over 645°C. There was no apparent trend in one area of the body being differentially burned than others but this may be directly related to the small amounts collected for burial. It was not possible to determine the original position of the individuals on the pyres due to the small quantity of remains recovered. There was not an obvious burning pattern on the remains which would have revealed an apparent trend in one area of the body being differentially burned than others; however this also may be directly related to the small amount collected for burial. Although the exact placement of the body cannot be known, it is presumed that the Slovenian individuals under study were placed supine on the pyre, which would have allowed for sufficient oxygen to all areas of the body and thus, adequate burning. It was not possible to know the exact maximum temperatures reached, but as evidenced by areas of calcination, it is clear that the fires reached >645°C in some cases.

It was discovered that the bones from all three sites exhibit high degrees of longitudinal, spiral, and transverse fracturing with marked warping and curling of the bone edges. This type of fracturing is indicative of the human remains being burned soon after death, with the flesh still attached. It cannot be known the exact treatment of the body between the time of death and placement on the pyre; however it can be concluded based on the absence of cut marks and the present fracture patterns that the body was not dismembered nor the flesh removed prior to firing.

As shown by the minute amount of bones recovered from each grave, only an extremely small percentage of the individual was collected for burial. Average bone weights of 1600 grams per individual have been calculated in other studies; this contrasts largely from the analyzed Slovenian assemblages where over 87% of the cremations contain less than 200 grams of bone. It would seem that although small in quantity, the amount of bone fragments placed into the grave may have been considered an adequate representation of the deceased.

Despite the overwhelming presence of skull and long bone fragments from all three sites, it cannot be assumed that there were specifically selected as these skeletal elements tend to survive cremation better than other areas of the body. It appears that bones were carefully hand-collected and selected for deposition in the urn. It is unknown what occurred to the cremated remains which were not placed into the urns or graves. As no pyre sites or other large caches of burned remains have been discovered in the studied area, it is possible that the remains were buried elsewhere, thrown into the nearby rivers, or distributed within the community to close family members and friends.

Animal bones were recovered from 18% of the cremations. This included both domesticated and non-domesticated animals. Although included in the cremation ritual, it is unknown if the carcasses were dismembered prior to burning or placed directly on the pyre. Fracture patterns on the animal remains indicate that the flesh was still attached at the time of burning; it is unclear if the remains were leftovers from the funerary feast, part of a sacrificial ritual, or symbols of social standing. The coloration of the animal bones remains is consistent with that of the human remains which indicates that both the deceased and the animal were burned at the same temperature and possibly on the same pyre. It is important to consider that if the amount of cremated bone extracted from the pyre was intended as a token deposit, the collection of burned animal remains may also have been an intentional aspect of the burial ritual.

Future Work

From several of the cremations, 10 samples were taken to be used in radiocarbon dating. The dates received from these samples are currently being used in correlation with the osteological and archaeological data from each site to create a large publication regarding temporal chronologies during the Urnfield Culture in Slovenia.

Additional research is also being done on other aspects of Urnfield Culture cremations within Slovenia which will be correlated with this dissertation for future publications. New sites have been discovered and the author has been performing the osteological analyses of the recovered cremation graves which are being integrated into studies regarding population demographics and mortuary practices throughout Central Europe.

This thesis has illustrated the need for more osteological studies, especially on cremated human remains, in Slovenia and further research into the cremation practices of the Urnfield Culture and it is clear that additional work must be done in order to broaden the understanding of bioarchaeology in Central Europe during the Late Bronze Age. In addition to further osteological studies, it is important that this research be utilized in correlation with other research so that a holistic view of the Urnfield Culture can be provided and integrated into the archaeological record for Central Europe.

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APPENDIX II

Ruše 1952

Grave 3

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 9.1 grams – 92%
5 mm – 0.7 grams – 7%
2 mm – less than 0.1 grams (3 fragments) – 1%
Total weight: 9.9 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

The total weight for this assemblage is 9.9 grams. There is one cranial fragment which is split between the diploë weighing 0.8 grams, 8 long bone fragments weighing 7.7 grams with spiral, longitudinal, and transverse fracturing, and 5 fragments weighing 1.4 grams that could not be identified. These fragments are tan in color.

Grave 4

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 5.0 grams – 69%

5 mm – 2.0 grams – 28%
2 mm – 0.3 grams – 3%
Total weight: 7.3 grams

Largest fragment: 22 mm (cranium)
Cranial thickness: 5 mm
Overall degree of burning: Low

The total weight of cremated remains from this grave is 7.3 grams. There are three cranial fragments weighing 3.6 grams. One of the fragments has a small blue fragment of bronze attached to it. This was not removed in order to prevent breaking of either the bone fragment or the artifact. There are five long bone fragments weighing 3.7 grams which exhibit spiral, longitudinal, and transverse fracturing. The bone fragments are dark tan in color, having been exposed to low temperatures for a short period of time.

Grave 9

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 8.4 grams – 100%
5 mm – 0 grams – 0%
2 mm – 0 grams – 0%
Total weight: 8.4 grams

Largest fragment: 37 mm (long bone)
Cranial thickness: Not taken
Overall degree of burning: Low

There are only four long bone fragments from this grave. One of the long bone fragments exhibits ripple mark type cracking on one side, similar to u-shaped fracturing. These fragments are white and tan in color and exhibit spiral, transverse, and longitudinal fracturing. Despite the sporadic white coloration of the bones, the bones have not been exposed to high temperatures or exposed to heat for prolonged period of time. It is uncertain what caused the white coloration present on the bones.

Grave 10

Sex: male? (browridge, rounded orbital bone)
Age: 14+ years (hand phalanx); 25-45 years (cranial suture)
Pathologies: none present

Size weights:
10 mm – 70.4 grams – 82%
5 mm – 15.3 grams – 18%
2 mm – 0 grams – 0%
Total weight: 85.7 grams

Largest fragment: 42 mm (cranium)
Cranial thickness: 3-4 mm
Overall degree of burning: Low

Total weight of this assemblage is 85.7 grams. There are 16 cranial fragments weighing 32.2 grams. On one of the fragments, there is a cranial suture which is moderately open, indicating a younger adult individual. There is a section of the right zygomatic arch and a section of the orbital bone with a rounded superior margin and protruding browridge, which tend to be characteristics of male individuals. There are 32 long bone fragments weighing 44.4 grams with transverse, spiral, and longitudinal fracturing and no surficial cracks. There is one rib fragment which is white in color which weighs 0.7 grams. There is the fused proximal end of a hand phalanx, most likely from a 5th proximal phalanx, which weighs 0.5 grams. There are also six fragments weighing 7.9 grams that could not be identified. These remains are beige and brown in color.

Grave 11

Sex: unidentified
Age: unidentified
Pathologies: none present

Size weights:
10 mm – 26.9 grams – 97%
5 mm – 0.7 grams – 3%
2 mm – 0 grams – 0%

Total weight: 27.6 grams

Largest fragment: 43 mm (long bone)
Cranial thickness: 4.5 mm
Overall degree of burning: Low

The total weight of cremated remains from this grave is 27.6 grams. The skeletal fragments present include 5 tan cranial fragments weighing 6.0 grams, 9 tan long bone fragments weighing 18.7 grams, one scapula fragment weighing 1.3 grams, and 1.6 grams of unidentifiable bone fragments. The cremains are tan in color with the long bone fragments exhibiting longitudinal, transverse, and spiral fracturing, with no surficial cracking.

Grave 11B

Sex: unidentifiable
Age: infant (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 1.6 grams – 16%
5 mm – 8.3 grams – 82%
2 mm – 0.2 grams – 2%
Total weight: 10.1 grams

Largest fragment: 19 mm (long bone)
Cranial thickness: 1.5-3 mm
Overall degree of burning: High

The total weight for this cremation is 10.1 grams. There are 17 cranial fragments, weighing 5.0 grams, which are bright white in color and are completely calcined. There are 11 long bone fragments that are white and beige with transverse and spiral fractures and no surficial checking. These fragments weigh 2.0 grams. There are also eight scapula fragments weighing 1.2 grams. The 15 unidentifiable fragments are bright white and beige, with slight soil staining and weigh 1.9 grams.

Grave 13

Sex: unidentifiable
Age: 15+ years (fused femoral head)
Pathologies: none present

Size weights:
10 mm – 49.7 grams – 97%
5 mm – 1.1 grams – 2%
2 mm – 0.4 grams – 1%
Total weight: 51.2 grams
Largest fragment: 38 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low/Moderate

The total weight of bone fragments from this grave is 51.2 grams. There are four cranial fragments weighing 4.2 grams, 2 vertebral fragments weighing 1.3 grams, 16 long bone fragments weighing 34.5 grams, and 13 unidentified fragments weighing 11.2 grams. One of the vertebral fragments is a portion of the centrum. One of the long bone fragments is the fused head of a femur with the fovea capitis present. This fragment weights 1.4 grams. The long bone fragments exhibit longitudinal, transverse, and spiral fracturing. The fragments are brown in color with black and blue colorations, mainly on the interior sections of bones.

Grave 13B

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 12.7 grams – 74%
5 mm – 4.1 grams – 24%
2 mm – 0.3 grams – 2%
Total weight: 17.1 grams

Largest fragment: 30 mm (cranium)
Cranial thickness: 3 mm (split between the diploë)
Overall degree of burning: Low

The total weight for this assemblage is 17.1 grams. There are three cranial fragments weighing 2.6 grams and 32 long bone fragments weighing 14.5 grams. The long bone fragments have serrated edges with transverse and longitudinal fracturing, surficial transverse cracking, and slight warping and curling of the edges. These fragments are tan and grey in color, indicative of low burning.

Grave 14

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 12.9 grams – 93%
5 mm – 1.0 grams – 7%
2 mm – 0 grams – 0%
Total weight: 13.9 grams

Largest fragment: 32 mm (long bone)
Cranial thickness: 3mm
Overall degree of burning: Low/High

The cremated remains weighed a total of 13.9 grams. There are two cranial fragments weighing 2.4 grams; the fragments are white on the external side and beige colored on the interior side, indicating higher temperatures on the external side of the cranial bones as opposed to the internal side. There are seven tan long bone fragments weighing 7.7 grams and exhibiting longitudinal and transverse fractures. There are three unidentifiable fragments weighing 3.8 grams which are comprised of mainly charred and dark brown spongy bone.

Grave 14B

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 0 grams

5 mm – 1.1 grams
2 mm – 0 grams
Total weight: 1.1 grams

Largest fragment: 13 mm (unidentifiable)
Cranial thickness: N/A
Overall degree of burning: High (calcined)

From this assemblage, there were only 1.1 grams of white bone fragments. None of the 14 fragments could be correctly identified to a specific skeletal element.

Grave 16

Sex: unidentifiable
Age: adult (cranial thickness); 13+ years (distal humerus); 14+ years (fused metacarpal); 15+ years (lesser trochanter); 16+ years (distal tibia)
Pathologies: none present

Size weights:
10 mm – 97.5 grams – 68%
5 mm – 41.9 grams – 29%
2 mm – 4.8 grams – 3%
Total weight: 144.2 grams

Largest fragment: 57 mm (cranium)
Cranial thickness: 5-6 mm
Overall degree of burning: Low to moderate

Total weight of bone fragments from this grave is 144.2 grams. There are 15 cranial fragments weighing 28.1 grams and 56 long bone fragments weighing 61.5 grams. The cranial bones are both split and unsplit between the diploë. There is the distal end of a left humerus, the distal end of a tibia, and a portion of the femur with the lesser trochanter. There is the fused distal end of a metacarpal which weighs 0.6 grams. These fragments have longitudinal, transverse, and curved or spiral fracturing and are tan in color with bluish-black coloring on the interior side of several fragments. There are 160+ unidentifiable fragments weighing 54.0 grams. With these bones, there are also 4 urn fragments weighing 0.4 grams.

Grave 18

Sex: unidentifiable
Age: 13+ years (fused ulna); 14+ years (fused phalanx); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 39.2 grams – 99%
5 mm – 0.2 grams – 0.5%
2 mm – 0.2 grams – 0.5%
Total weight: 39.6 grams

Largest fragment: 34 mm (cranium)
Cranial thickness: 4.5 mm
Overall degree of burning: Low

Total weight of cremated bone fragments is 39.6 grams. There are 10 cranial fragments weighing 14.1 grams, 18 long bone fragments weighing 21.2 grams, one hand fragment weighing 0.5 grams, two rib fragments weighing 0.5 grams, and 5 unidentified fragments weighing 3.0 grams. One of the long bone fragments is the coronoid process of an ulna. The hand fragment is the fused proximal end of a proximal phalanx. The fragments are dark brown in color. The long bone fragments exhibit longitudinal, transverse, and serrated fracturing with edge curling. There is one bone fragment that was separated from the assemblage as a potential animal bone, as it is smaller than an adult phalanx and is not a fragment of a juvenile phalanx. It weighs 0.3 grams.

Grave 19

Sex: unidentifiable
Age: 13+ years; 15+ years (fused radial head; fused humeral head)
Pathologies: none present

Size weights:
10 mm – 108.9 grams – 84%
5 mm – 20.1 grams – 15.5%
2 mm – 0.6 grams – 0.5%
Total weight: 129.6 grams

Largest fragment: 70 mm (long bone)
Cranial thickness: 3.5-4 mm
Overall degree of burning: Low

The total weight of bone fragments is 129.6 grams. There are 11 cranial fragments weighing 24.2 grams, one being a small right mandibular condyle and the other being a portion of the occipital bone. There are 52 long bone fragments weighing 89.3 grams; of these fragments, the fused head of a humerus and a small fused radial head are present. The long bone fragments exhibit longitudinal, spiral, and transverse fracturing with several deep surficial cracks and edge curling. There are 20 unidentified fragments weighing 14.1 grams. There are three additional animal rib fragments weighing 2.0 grams.

Grave 19(2)

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 0 grams – 0%
5 mm – 2.0 grams – 0%
2 mm – 0 grams – 0%
Total weight: 2.0 grams

Largest fragment: 26 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low/Moderate/High

The total weight of this assemblage is 2.0 grams. There are four white scapula fragments weighing 0.7 grams, three long bone fragments weighing 1.2 grams, and 2 unidentified fragments weighing 0.1 grams. The long bone fragments exhibit deep exterior curved and transverse cracking on some fragments, edge curling, and transverse, spiral, and longitudinal fracturing. These fragments are white and tan in color with small areas of dark blue.

Grave 20

Sex: unidentifiable
Age: 13+ years (fused distal humerus), 20+ years (fused vertebral ring)
Pathologies: spinal degeneration

Size weights:
10 mm – 14.9 grams – 94%
5 mm – 0.9 grams – 6%
2 mm – 0 grams – 0%
Total weight: 15.8 grams

Largest fragment: 37 mm (rib)
Cranial thickness: 2 mm (one table only)
Overall degree of burning: Low

The total weight of this assemblage is 15.8 grams. There are ten tan cranial fragments that are beige/tan in color and weigh 5.0 grams. The fragments are all split between the cranial tables. There are four brown rib fragments weighing 2.8 grams, six long bone fragments weighing 5.6 grams, one vertebral fragments weighing 0.7 grams, and nine unidentified fragments weighing 1.7 grams. The sole vertebral fragment present is a section of the centrum that exhibits slight lipping on the edge of the vertebral body. One of the long bone fragments is a portion of the fused distal epiphysis of the right humerus. The long bone fragments exhibit longitudinal, spiral, and transverse fracturing. The unidentified fragments exhibit grayish-blue burning on the interior side. There is one fragment which may be a piece of a maxilla from an animal, but is too fragmented to make an accurate determination.

Grave 21

Sex: female?
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 28.0 grams – 88%
5 mm – 3.9 grams – 12%
2 mm – 0 grams – 0%
Total weight: 31.9 grams

Largest fragment: 37 mm (long bone)
Cranial thickness: 3-5 mm
Overall degree of burning: Low

The total weight for this assemblage is 31.9 grams. There are 11 cranial fragments, with two fragments both being from the orbital bone with supraorbital tori present. One of the orbital fragments is from the left side of the calavaria with a sharp superior margin while the other fragment is from the right side, is more robust, and has a slightly less sharp superior margin. While the presence of two orbital sections of slightly varying shape and robusticity may indicate two individuals, it is likely that these fragments are from the same individual, and possibly a female individual due to the sharp superior margin. These fragments weigh 13.4 grams. There are 15 tan long bone fragments with slight patina checking on the surface and longitudinal, spiral, and transverse fracturing that weigh 18.1 grams. There are also 2 unidentified fragments weighing 0.4 grams.

Grave 23

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 49.4 grams – 78%
5 mm – 13.2 grams – 21.5%
2 mm – 0.4 grams – 0.5%
Total weight: 63.0 grams

Largest fragment: 41 mm (long bone)
Cranial thickness: 2.5-3 mm
Overall degree of burning: Low

The total weight is 63.0 grams. There are five cranial fragments weighing 3.2 grams. There are 33 long bone fragments weighing 45.2 grams which exhibit transverse and longitudinal fracturing. Of these 33 fragments, there are portions of the proximal epiphysis of the right ulna with the radial notch present, the proximal end of a radius, 2 distal ends of the tibias, and the head of a humerus. There are two tan rib fragments weighing 0.9 grams, one with a tubercle, and four tan scapula fragments weighing 2.8 grams. There is one fragment of a glenoid fossa and one fragment of the inferior angle. There are 2 hand/foot bone fragments weighing 0.8 grams; one fragment is a proximal end and shaft of a metatarsal and another shaft fragment from either a hand or foot. There are also 2 pelvic fragments weighing 3.1 grams. All of the long bone fragments and the metatarsal shaft are all too weathered and damaged to make an accurate determination regarding whether the ends are fused or not. There are 25+ unidentifiable fragments which are brown and white in color and weigh 7.0 grams

Grave 26

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 8.4 grams – 94%
5 mm – 0.3 grams – 3%
2 mm – 0.2 grams – 3%
Total weight: 8.9 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Moderate

Total weight of this assemblage is 8.9 grams. There are three cranial fragments that are brown and tan in color and weigh 1.7 grams. There are seven long bone fragments weighing 4.7 grams that are light grey with longitudinal and transverse fracturing. There are nine unidentified fragments weighing 2.5 grams which are dark brown and charred. Many of the pieces are comprised of mainly spongy, cancellous bone and may be portions of the pelvis but an accurate identification could not be made.

Grave 29

Sex: unidentifiable
Age: 14+ years (fused metacarpal 2/3); adult (metatarsal size); adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 25.8 grams – 94%
5 mm – 1.7 grams – 6%
2 mm – 0 grams – 0%
Total weight: 27.5 grams

Largest fragment: 45 mm (unidentifiable)
Cranial thickness: 3.5-5 mm
Overall degree of burning: Low

These remains weigh 27.5 grams in total and are tan in color. There are four cranial fragments weighing 2.7 grams with slight surficial cracking. There are nine long bone fragments present with longitudinal, spiral, and transverse fracturing and weighs 6.6 grams. The distal end of the right 1st metatarsal is present which weighs 2.3 grams and is brown in color and the fused distal end of either metacarpal 2 or 3, weighing 1.2 grams. There are seven unidentifiable fragments which weigh 14.7 grams and are brown in color.

Grave 29B

Sex: unidentified
Age: unidentified
Pathologies: none present

Size weights:
10 mm – 4.0 grams – 100%
5 mm – 0 grams – 0%
2 mm – 0 grams – 0%
Total weight: 4.0 grams

Largest fragment: 21.5 mm (long bone)
Cranial thickness: 2.5 grams (split between diploë)
Overall degree of burning: Low/High

There are only 8 fragments weighing 4.0 grams from this assemblage. Three of the fragments are from the cranium (1.7 grams), three from long bones (1.5 grams), and two that were unidentifiable (0.8 grams). These fragments are tan with calcination in places due to sporadic burning and exhibit longitudinal and spiral fracturing.

Grave 29(2)

Sex: unidentified
Age: adult (scapula morphology)
Pathologies: none present

Size weights:
10 mm – 12.0 grams – 100%
5 mm – 0 grams – 0%
2 mm – 0 grams – 0%
Total weight: 12.0 grams

Largest fragment: 34 mm (unidentifiable)
Cranial thickness: N/A
Overall degree of burning: High

This assemblage also has 8 fragments and weighs 12.0 grams. There are two long bone fragments weighing 2.8 grams that are white in color. There is one scapula fragment which weighs 0.8 grams and is a blackened, very thick portion of the vertebral border. There are five unidentifiable fragments which are blackened with white edges and weigh 8.4 grams. The remains exhibit longitudinal, spiral, and transverse fracturing with no surficial cracking.

Grave 34

Sex: unidentified
Age: unidentified
Pathologies: none present

Size weights:
10 mm – 14.4 grams – 79%
5 mm – 3.8 grams – 21%
2 mm – 0 grams – 0%
Total weight: 18.2 grams

Largest fragment: 31.5 mm (long bone)
Cranial thickness: 3.5-5 mm
Overall degree of burning: Low

The total weight of cremated remains from this grave is 18.2 grams. There are 15 beige cranial fragments weighing 11.5 grams, nine tan long bone fragments weighing 4.5 grams, and 7 unidentified fragments weighing 2.2 grams. The long bone fragments exhibit longitudinal, spiral, and transverse fracturing with no surficial cracking.

Grave 86

Sex: unidentifiable
Age: Under 23 years (unfused iliac crest)
Pathologies: none present

Size weights:
10 mm – 12.7 grams – 66%
5 mm – 6.6 grams – 34%
2 mm – 0 grams – 0%
Total weight: 19.3 grams

Largest fragment: 44.5 mm (cranium)
Cranial thickness: 3-3.5 mm
Overall degree of burning: Low

The fragments present from this grave are beige and tan in color with the degree of burning being at a very low level and weigh in total at 19.3 grams. Several of the fragments exhibit a white discoloration, likely due to soil staining. There are four cranial pieces weighing 5.4 grams, 16 long bone fragments weighing 8.9 grams, one rib fragment weighing 0.4 grams, three pelvic fragments weighing 2.9 grams, and nine fragments weighing 1.7 grams that could not be identified. One of the pelvis fragments is a fragment of the unfused iliac crest. The long bone fragments exhibit longitudinal and transverse fractures with very few surficial transverse cracks. Two long bone shaft fragments weighing 2.3 grams were taken for a sample.

Ruše 1993

Grave 8

Sex: unidentifiable

Age: 14+ years (distal metatarsals/metacarpal, proximal phalanx); 17+ years (glenoid fossa); adult (navicular morphology)
Pathologies: none present

Size weights:
10 mm – 127.9 grams – 42%
5 mm – 103.8 grams – 35%
2 mm – 68.7 grams – 23%
Total weight: 300.4 grams

Largest fragment: 48 mm (long bone)
Cranial thickness: 2.5-3.5 mm
Overall degree of burning: Moderate

The total weight of bone fragments from this grave is 300.4 grams. There are 59 light grey and white cranial fragments with blue edges weighing 22.2 grams that are split mainly between the inner and outer cranial tables. There are 116 long bone fragments weighing 78.1 grams, two pelvic fragments weighing 1.5 grams, and seven light grey and white rib fragments weighing 3.1 grams. The long bone fragments are tan, brown, and light grey in color with u-shaped, longitudinal, transverse, and spiral fracturing. There are five vertebral fragments weighing 5.9 grams. Of these fragments, there is a portion of a centrum, an articular facet with a portion of the pedicle, and another centrum with attached transverse process from a cervical vertebra. There are five scapula fragments weighing 1.3 grams which are grey and white in color. There is a fragment of a fused glenoid fossa. There are six hand/foot fragments in total, weighing 3.2 grams. There are three fragments of fused distal ends of metatarsals, the proximal end of a distal phalanx from the hand, a navicular, and the distal end of either a metacarpal or metatarsal. These fragments are all light brown in color. There are ~1600 unidentified fragments from this assemblage, weighing 185.1 grams. Additionally, there are 86.0 grams of soil and 16.7 grams of charcoal and rock that were present with the bone fragments.

Grave 9

Sex: unidentifiable
Age: adult (cranial thickness)

Pathologies: none present

Size weights:
10 mm – 37.4 grams – 34%
5 mm – 52.8 grams – 47%
2 mm – 21.8 grams – 19%
Total weight: 112.0 grams

Largest fragment: 38 mm (long bone)
Cranial thickness: 4-5 mm
Overall degree of burning: Low

The total bone weight from this grave is 112.0 grams. There are 29 cranial fragments weighing 15.8 grams and 57 long bone fragments weighing 39.8 grams. There is a fragment of the centrum of a vertebra weighing 1.0 grams and three tan rib fragments weighing 2.1 grams. There is one scapula fragment weighing 0.2 grams which is a portion of the lateral border. There are over 100 fragments weighing 53.1 grams that could not be identified. The long bone fragments display no surface cracks, are tan in color, and display transverse, spiral, and longitudinal fracturing. In addition to bone fragments, there was one unidentified artifact weighing 0.1 grams, 18.0 grams of charcoal and bone dust, and 3.8 grams of charcoal and rock fragments.

Grave 32

Sex: female? (radial head measurement)
Age: 13+ years (proximal radius); 14+ years (distal metacarpal); 21+ years (complete 3rd molar socket)
Pathologies: none present

Size weights:
10 mm – 196.0 grams – 67%
5 mm – 76.4 grams – 26%
2 mm – 18.2 grams – 7%
Total weight: 290.6 grams

Largest fragment: 50 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Low/Moderate

Total bone weight is 290.6 grams. There are 32 cranial fragments weighing 39.2 grams. The right side of the mandible with a large tooth socket of a 3rd permanent molar, lost postmortem, is present. There are 111 long bone fragments weighing 173.9 grams, five tan rib fragments weighing 1.9 grams, one tan vertebral fragment weighing 0.6 grams, four tan pelvic fragments weighing 3.9 grams, and 450 + unidentified fragments weighing 66.7 grams. There is a radial head with a diameter of 22 mm. There is one scapula fragment weighing 0.7 grams which is tan and white in color and is a border fragment. There are two hand fragments; one being a portion of a scaphoid and the other being the fused distal end of a metacarpal. These fragments weigh 0.9 grams. The interior portion of the bones is blue, black, and grey with the external side being tan in color. There are lots of surficial/patina cracking on the larger fragments with slight curling of the edges and longitudinal, spiral, and transverse fracturing. There are also 61.3 grams of soil. There are also two bones which weigh 2.8 grams that are animal bones part of the maxilla, tan grey and white in color.

Brinjeva gora

Grave 1

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 66.7 grams – 78%
5 mm – 18.4 grams – 22%
2 mm – 0 grams – 0%
Total weight: 85.1 grams

Largest fragment: 48 mm (long bone)
Cranial thickness: 3.5-4.5 mm
Overall degree of burning: Moderate

There are six cranial fragments weighing 3.4 grams which are blue and black in color with slight white coloration at the edges. There are 51 long bone fragments weighing

81.4 grams. These fragments are dark blue and black on the interior portion of the bone, white on the cortical surface. These fragments exhibit longitudinal, transverse, and spiral fracturing. There is one bone fragment that could not be identified which weighs 0.3 grams. There are also two rocks with this assemblage weighing 3.3 grams.

Grave 2

Sex: unidentifiable
Age: 13+ years (proximal ulna); 16+ years (iliac crest); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 71.2 grams – 61.5%
5 mm – 43.8 grams – 38%
2 mm – 0.7 grams – 0.5%
Total weight: 115.7 grams

Largest fragment: 42 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Moderate

There are 40 cranial fragments weighing 32.6 grams. These fragments vary in color from tan to grey to black and are both split and unsplit between the cranial tables. There are 81 long bone fragments weighing 68.4 grams with longitudinal, transverse, and spiral fracturing. One of the fragments is the fused olecranon process of the right ulna. The fragments are mainly blue and grey in color; however there is one fragment with a slight greenish-blue stain due to contact with a bronze artifact. There is one rib fragment weighing 0.5 grams. There is one fragment of the iliac crest weighing 1.6 grams. There is one fragment of the articular side of the navicular and one fragment of the talus; both these foot fragments weigh 3.7 grams. These fragments are brown and grey-white in color. There are 25 unidentifiable fragments weighing 8.9 grams which are dark grey and white in color. There is also one iron fragment which weighs less than 0.1 grams and 15.3 grams of rocks and urn fragments.

Grave 3

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 29.7 grams – 45%
5 mm – 31.6 grams – 48%
2 mm – 4.1 grams – 7%
Total weight: 65.4 grams

Largest fragment: 34 mm (long bone)
Cranial thickness: 4.5 mm
Overall degree of burning: Low/Moderate

There are 34 cranial fragments which are tan and dark grey in color and weigh 20.4 grams. Many of the fragments are split between the cranial tables and along the sutures. There are 57 long bone fragments weighing 35.7 grams; these bones are tan and black with slight blue coloration. The long bone fragments also exhibit longitudinal, transverse, and spiral fracturing. There is one grey phalanx shaft fragment that weighs 0.5 grams. This fragment exhibits longitudinal and transverse fracturing; however it is uncertain whether the bone is a fragment of a hand or foot phalanx. There are 58 unidentified fragments weighing 8.8 grams which are mainly dark brown and black in color, with slight white coloring on the external portion of the bones. There is one urn fragment, soil, and bone dust which weighs 3.1 grams. In this stage, many of the bones are tan in color (low burn, but there are others which are dark, showing that many of the bones were exposed to high burning).

Grave 6

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 14.7 grams – 61%
5 mm – 9.3 grams – 39%
2 mm – 0 grams – 0%
Total weight: 24.0 grams

Largest fragment: 27 mm (long bone)
Cranial thickness: 5mm (without inner table)
Overall degree of burning: Moderate

There are 10 cranial fragments weighing 6.9 grams. Three of the ten fragments are tan and have barely been burned, while the rest are charred black with blue and grey edges. There are 28 long bone fragments weighing 16.7 grams that exhibit spiral, longitudinal, and transverse fracturing and range in color from dark brown and black with grey and white edges. There are two unidentifiable fragments weighing 0.4 grams and five urn fragments weighing 4.1 grams. There is also an unknown artifact weighing 0.8 grams, which may be a piece of soapstone.

Grave 7

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 36.1 grams – 83%
5 mm – 7.3 grams – 17%
2 mm – 0 grams – 0%
Total weight: 43.4 grams

Largest fragment: 43 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Moderate

The total weight of this assemblage is 43.4 grams. There are 17 cranial fragments weighing 17.1 grams. These fragments are mainly dark blue in color, although several have a white cortex and some are tan and grey. There are 15 long bone fragments weighing 23.8 grams and three unidentifiable fragments that weigh 2.5 grams. The long bone fragments exhibit u-shaped, longitudinal, transverse, and spiral fracturing. There are also two urn fragments weighing 2.7 grams.

Grave 9

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 27.7 grams – 70%
5 mm – 11.8 grams – 29.5%
2 mm – 0.2 grams – 0.5%
Total weight: 39.7 grams

Largest fragment: 38 mm (long bone)
Cranial thickness: 4-7 mm
Overall degree of burning: Low/Moderate

There are 39.7 grams of bone fragments from this grave. There are 12 tan cranial fragments weighing 7.8 grams, 20 long bone fragments weighing 30.4 grams with longitudinal, spiral, and transverse fracturing, and four unidentifiable fragments weighing 1.5 grams. These fragments are tan, grey, and dark brown in color with white edges.

Grave 10

Sex: unidentifiable
Age: 12-15 years (incomplete maxillary 2nd premolar), 11-12 years (incomplete mandibular 1st premolar); under 23 years (unfused iliac crest); under 21 years (unfused middle phalanx- hand or foot unknown); 11-15 years (complete permanent maxillary canine/1st incisor)
Pathologies: none present

Size weights:
10 mm – 45.0 grams – 23%
5 mm – 114.2 grams – 59%
2 mm – 35.5 grams – 18%
Total weight: 194.7 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: 2-2.5 mm
Overall degree of burning: Moderate/High

There are 163 cranial fragments weighing 46.3 grams. There is one blue and white fragment of the petrous bone with the rest of the cranial bones are tan in color and split and unsplit between the cranial tables. There are three white and blue teeth fragments weighing 0.6 grams. One is either a permanent maxillary canine or 1st incisor, one a permanent maxillary 2nd premolar, and one a permanent 1st mandibular premolar. The apices of both the maxillary 2nd premolar and 1st mandibular premolar tooth roots are incomplete indicating an age range of approximately 12 years. There are 22 rib fragments weighing 2.9 grams which are tan and light grey in color. There are 9 white and beige hand/foot fragments; one fragment is a portion of the superior articular surface of the talus and there is an unfused middle phalanx, proximal end unfused. There are also tiny shaft fragments with unfused proximal ends. These fragments weigh 5.0 grams and provide an age range of under 21 years. There are 15 scapula fragments weighing 1.6 grams and are tan and light grey in color. There are 195 long bone fragments weighing 95.8 grams which have u-shaped, longitudinal, transverse, and spiral fracturing. These bones vary in colors including tan, grey, black, blue, and white, indicating exposure to varying degrees of temperature and heat, with most bones just starting to reach complete calcination. There is one beige fragment of the unfused iliac crest weighing 0.6 grams. This fragment provides an age range of less than 23 years. There are also 375 unidentified fragments weighing 40.7 grams and 26.2 grams of rocks, soil, and bone dust. There is one unfused distal end of a long bone from an animal (1.2 grams).

Grave 12

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:

10 mm – 130.8 grams – 36%
5 mm – 213.4 grams – 58%
2 mm – 24.2 grams – 6%
Total weight: 368.4 grams

Largest fragment: 38 mm (long bone)
Cranial thickness: 6-7 mm
Overall degree of burning: Moderate

There are 146 cranial fragments. These bones weigh 95.6 grams and are dark grey and blue in color. They are mainly split between the cranial tables, however, there are several fragments where the tables are still connected. There are 11 grey scapula fragments which weigh 4.0 grams. There are several body fragments and one fragment of the vertebral border. There are three pelvic fragments weighing 5.0 grams and are grey in color. There are two beige rib fragments weighing 0.6 grams. There are 248 long bone fragments weighing 210.3 grams with longitudinal, transverse, and spiral fracturing. These fragments are dark grey in color; there are two shaft fragments which are either from the ulna or radius. There are 250 fragments which could not be assigned to a specific skeletal element. These fragments are dark and light grey in color and weigh 52.9 grams.

Grave 13

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 29.8 grams – 77%
5 mm – 8.7 grams – 23%
2 mm – 0 grams – 0%
Total weight: 38.5 grams

Largest fragment: 42 mm (long bone)
Cranial thickness: 5-6 mm
Overall degree of burning: Moderate/High

There are 38.5 grams from this assemblage. There are nine cranial fragments weighing 8.2 grams which are dark brown in color with the external cortical bone being white. There are 21 long bone fragments weighing 28.4 grams with u-shaped, spiral, longitudinal, and transverse fracturing. There is a long bone present either from the raidus or ulna with the interosseous crest. No patina checking is present. There are four fragments which could not be identified, weighing 1.9 grams. There are also four urn fragments weighing 16.2 grams.

Grave 14

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present
Size weights:
10 mm – 12.3 grams – 79%
5 mm – 3.2 grams – 21%
2 mm – 0 grams – 0%
Total weight: 15.5 grams

Largest fragment: 36 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Moderate/High

There is 15.5 grams of bone fragments present. There are nine long bone fragments weighing 13.7 grams that are dark grey and blue with a white exterior. These fragments have longitudinal, transverse, and u-shaped fracturing. There are two unidentified fragments weighing 1.8 grams; one fragment is tan and the other is dark blue-grey and white.

Grave 15

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 34.5 grams – 41%

5 mm – 45.4 grams – 54%
2 mm – 3.9 grams – 5%
Total weight: 83.8 grams

Largest fragment: 43 mm (long bone)
Cranial thickness: 3 mm
Overall degree of burning: Low

There are 17 cranial fragments weighing 8.3 grams. These fragments are tan in color and are split between the cranial tables and along the sutures. There are three tan rib fragments weighing 0.8 grams. There is one vertebral fragment, being a portion of the vertebral body with adjoining pedicle. This fragment is tan in color and weighs 0.9 grams. There are 2 scapula fragments weighing 1.1 grams. One of the fragments is tan in color and the other is blue. The blue fragment is a thick piece of the vertebral border and the tan fragment is a thin section of the scapular body. There are 76 long bone fragments with longitudinal, transverse, and spiral fracturing and surficial cracking. These fragments are mainly tan in color, with several being bluish-grey or blackened; these fragments weigh 59.7 grams. There are 68 unidentifiable fragments which weigh 13.0 grams and are tan and black in color with bluish-grey edges. There are 10.9 grams of soil, rocks, and bone dust.

Grave 15B

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 16.5 grams – 65%
5 mm – 8.3 grams – 33%
2 mm – 0.5 grams – 2%
Total weight: 25.3 grams

Largest fragment: 35 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Moderate

There is 25.3 grams of bone fragments from this grave. There is one dark brown cranial fragment weighing 0.7 grams, 26 long bone fragments weighing 20.8 grams, and 21 unidentified fragments weighing 3.8 grams. The long bone fragments exhibit longitudinal and transverse fracturing with several displaying spiral fractures. These bones have a blue interior and a white exterior. There is also one wood fragment that weighs 0.1, soil weighing 1.4 grams, and one urn fragment at 0.6 grams.

Grave 17

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 13.9 grams – 43%
5 mm – 17.8 grams – 56%
2 mm – 0.4 grams – 1%
Total weight: 32.1 grams

Largest fragment: 31 mm (long bone)
Cranial thickness: 6 mm
Overall degree of burning: Moderate

There are 32.1 grams of bone fragments from this grave. There are 11 cranial fragments weighing 11.9 grams. One of the fragments has a suture, which is moderately open and typical of an adult. There are 24 tan and greyish-blue long bone fragments with longitudinal and transverse fracturing, curled edges, and weigh 17.6 grams. There are six fragments weighing 2.6 grams that could not be identified. There is also one urn fragment weighing 1.8 grams and 3.0 grams of soil with one rock.

Grave 19

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 4.2 grams – 40%
5 mm – 6.3 grams – 59%
2 mm – 0.1 grams – 1%
Total weight: 10.6 grams

Largest fragment: 23 mm (long bone)
Cranial thickness: 3 mm
Overall degree of burning: Moderate

The total bone weight from this grave is 10.6 grams. There is one white cranial fragment weighing 0.4 grams, 11 long bone fragments weighing 7.5 grams, and 16 fragments weighing 2.7 grams that could not be identified. The remains are black and grey with some areas of light brown and tan, with longitudinal and transverse fracturing. There are also 0.8 grams of soil.

Grave 20

Sex: unidentifiable
Age: adult (50+) (obliterated suture, cranial thickness)
Pathologies: cranial pitting (porotic hyperostosis)

Size weights: photo with hole in animal bone
10 mm – 37.6 grams – 32%
5 mm – 65.6 grams – 56%
2 mm – 13.4 grams – 12%
Total weight: 116.6 grams

Largest fragment: 41 mm (long bone)
Cranial thickness: 5-7 mm
Overall degree of burning: Moderate

There are 39 cranial fragments weighing 24.1 grams which are tan in color. Most of the cranial fragments have a cranial thickness of 5 mm however there is one blackened fragment which has a cranial thickness of 7 mm. There is a fragment which exhibit cranial pitting typical of porotic hyperostosis with additional lamellar growth (may also be from supraorbital margin type pitting). There is also one fragment with an obliterated cranial suture, indicating an older individual (50+). There are 92 long bone fragments weighing 75.3 grams. These fragments are mainly tan with small areas of bluish-grey and have longitudinal, transverse, and spiral fracturing with several fragments exhibiting deep surficial cracking. There are 139 fragments which could not be identified to a specific skeletal element which weigh 16.6 grams. These fragments are tan in color. There is one animal bone weighing 0.6 grams; this fragment has been identified as vertebral fragment.

Grave 21

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 71.5 grams – 55%
5 mm – 50.6 grams – 39%
2 mm – 6.9 grams – 6%
Total weight: 129.0 grams

Largest fragment: 40 mm (cranium)
Cranial thickness: 6-7 mm
Overall degree of burning: Low/High

There are 74 cranial fragments weighing 81.6 grams. These fragments are dark blue and grey in color. There are 56 long bone fragments weighing 34.6 grams. These fragments are light grey and blue in color with longitudinal, transverse, and spiral fracturing. There are no surficial cracks on these fragments. There are two scapula fragments which are tan in color and weigh 0.4 grams; these fragments are a fragment of the vertebral border and the scapular body. There are 81 fragments that could not be identified to a specific skeletal element; these are tan in color and weigh 12.4 grams. There is also 8.2 grams of bone dust and soil and a wood fragment weighing 0.1 grams.

Grave 22

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 4.2 grams – 56%
5 mm – 3.1 grams – 41%
2 mm – 0.2 grams – 3%
Total weight: 7.5 grams

Largest fragment: 22 mm (long bone)
Cranial thickness: 3 mm
Overall degree of burning: Low

There are 7.5 grams of bone fragments from this grave. There are two cranial fragments weighing 0.8 grams, seven long bone fragments weighing 4.0 grams, and three fragments that may be animal bone weighing 1.9 grams. There are also five unidentified fragments weighing 0.8 grams. These fragments are mainly tan in color with areas of dark grey, blue, and white. There is one piece of plant material with negligible weight and 2.3 grams of soil.

Grave 23

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 88.2 grams – 73%
5 mm – 33.1 grams – 27%
2 mm – 0 grams – 0%
Total weight: 121.3 grams

Largest fragment: 46 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Moderate

There are 32 cranial fragments. These fragments are not split between the cranial tables, but are split along several sutures. These fragments are blackened with blue coloration on the interior side and white on the external surface; these fragments weigh 46.1

grams. There are 62 long bones fragments with dark coloring on the internal surface of the bone with white coloring on the external cortical bone. These fragments exhibit longitudinal, transverse, and spiral fracturing with slight surficial cracking on the cortical surface. These bones weigh 73.1 grams. There are four unidentified fragments weighing 2.1 grams. There are 24 urn fragments weighing 25.6 grams and 4.2 grams of soil present in addition to the cremains.

Grave 24

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 64.3 grams – 61%
5 mm – 39.7 grams – 38%
2 mm – 1.6 grams – 1%
Total weight: 105.6 grams

Largest fragment: 42 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Moderate

There are 17 cranial fragments weighing 17.7 grams. The fragments range in color from tan to grey with several fragments being blackened with white edges. There are fragments that are split between the cranial tables and those that have not separated between the diploë. There are three brown and grey scapula fragments weighing 1.9 grams. There are 75 long bone fragments weighing 81.3 grams. These fragments have longitudinal, spiral, and transverse fracturing with slight superficial cracking and are tan, black, bluish-grey, and white in color, representing variation in exposure to heat. A long bone fragment was taken as a sample for radiocarbon dating. There are 19 brown unidentified fragments weighing 4.7 grams.

Grave 25

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 62.6 grams – 56%
5 mm – 47.8 grams – 42%
2 mm – 2.2 grams – 2%
Total weight: 112.6 grams

Largest fragment: 46 mm (long bone)
Cranial thickness: 3.5 mm – 4 mm
Overall degree of burning: Low

There are nine cranial fragments weighing 5.8 grams. These fragments are tan in color with slight blue-grey coloring on the edge of the bones. Some of the fragments have split between the cranial tables, while others have not. There are three tan scapula fragments weighing 1.0 grams. One fragment is a portion of the vertebral border and the other two are fragments of the scapular body. There are 108 tan long bone fragments weighing 103.8 grams. These fragments have longitudinal, transverse, and spiral fracturing with edge curling. There are 10 grey unidentified fragments weighing 2.0 grams. There are also 7.3 grams of soil and bone dust.

Grave 26

Sex: unidentified
Age: 15+ years (permanent maxillary molar); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 17.4 grams – 37%
5 mm – 29.7 grams – 62%
2 mm – 0.3 grams – 1%
Total weight: 47.4 grams

Largest fragment: 27 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Moderate

There are 29 cranial fragments weighing 23.8 grams and one permanent maxillary molar weighing 0.6 grams which is blackened and all three roots have broken away from the top of the tooth. There are 35 long bone fragments weighing 20.9 grams with a dark brown interior and white exterior, exhibiting transverse and longitudinal fracturing. There are nine fragments which could not be identified that weigh 1.8 grams. There is a long bone shaft from an animal which weighs 0.3 grams and 1.8 grams of soil.

Grave 27

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 182.7 grams – 56%
5 mm – 139.1 grams – 43%
2 mm – 4.3 grams – 1%
Total weight: 326.1 grams

Largest fragment: 40.5 mm (long bone)
Cranial thickness: 6 mm
Overall degree of burning: Moderate

There are 326.1 grams of bone fragments from this assemblage. There are 67 cranial fragments weighing 54.5 grams that are mainly dark brown and tan with calcined white and blue-grey in places. There are 192 long bone fragments weighing 237.6 grams. These fragments are tan and black with white and blue-grey edges and exhibit u-shaped, longitudinal, spiral, and transverse fracturing. There are 120 fragments that could not be identified weighing 34.0 grams, one wood fragment weighing 0.1 grams, and 51.1 grams of soil and bone dust.

Grave 28

Sex: unidentifiable

Age: 14+ years (fused phalanx); 21+ years (complete mandibular 3rd molar); adult (cranial thickness)
Pathologies: cranial lesions/pitting (porotic hyperostosis)

Size weights:
10 mm – 370.7 grams – 68%
5 mm – 167.1 grams – 31%
2 mm – 6.3 grams – 1%
Total weight: 544.1 grams

Largest fragment: 73.5 mm (cranium)
Cranial thickness: 5-7 mm
Overall degree of burning: Moderate/High

There are 87 dark brown cranial fragments weighing 111.7 grams; there are several fragments which exhibit porotic hyperostosis. There is one tooth fragment; it weighs 0.9 grams and is black in color with slightly white edging. This is a fragment from a permanent mandibular 3rd molar, with one root having been broken off. There are 259 black long bone fragments weighing 340.0 grams. The long bone fragments exhibit longitudinal, spiral, u-shaped, and transverse fracturing with slight shallow surficial cracking on several fragments. There is also the fused proximal end of a hand phalanx. It is black in color and weighs 0.3 grams. There is one scapula fragment weighing 0.7 grams which is grey and white in color. There is also one dark brown rib fragment weighing 0.5 grams. There are 227 black fragments which could not be identified that weigh 90.0 grams.

Grave 29

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 8.8 grams – 100%
5 mm – 0 grams – 0%
2 mm – 0 grams – 0%
Total weight: 8.8 grams

Largest fragment: 24 mm (long bone)
Cranial thickness: 7 mm (based on one fragment)
Overall degree of burning: Moderate

There is one cranial fragment which has dark brown cancellous bone on the interior and white cortical bone on the exterior. It weighs 0.8 grams and has a cranial thickness of approximately 7 mm. There are seven long bone fragments which are dark brown and black in color with white and light grey coloring on the external cortical bone. These bones weigh 8.0 grams and have transverse, longitudinal, and very slight spiral fracturing.

Grave 30

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 66.3 grams – 85.0%
5 mm – 11.3 grams – 14.9%
2 mm – 0.1 grams – 0.1%
Total weight: 77.7 grams

Largest fragment: 47 mm (cranium)
Cranial thickness: 7 mm
Overall degree of burning: Moderate/High

There are 16 cranial fragments, black in color with white-blue edges which weigh 32.8 grams. One of the fragments has a cranial thickness of 7 mm. Most of these fragments are not split between the cranial tables. There are 32 long bone fragments weighing 40.4 grams with longitudinal, spiral, and transverse fracture patterns. They are dark brown in color with bluish-white coloring on the edges. There are two long bone fragments which are animal bones and have not been exposed to heat weighing 4.5 grams which are brown in color. There are two brown urn fragments weighing 4.2 grams and soil/bone dust weighing 6.1 grams.

Grave 31(a)

Sex: unidentified
Age: 15+ years (fused greater trochanter); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 13.7 grams – 88%
5 mm – 1.9 grams – 12%
2 mm – 0 grams – 0%
Total weight: 15.6 grams

Largest fragment: 32 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Moderate/High

There are 15.6 grams of bone fragments. There are three cranial fragments weighing 4.7 grams that are dark brown with white along the edges and have broken along sutures. There are nine long bone fragments with longitudinal, spiral, and transverse fractures that weigh 10.1 grams and are dark blue and white in color with dark brown coloration on the interior side and white on the exterior side. One of the long bone fragments is a portion of the fused greater trochanter from the femur. There are three unidentified bones weighing 0.8 grams. There are 2.5 grams of soil and three urn fragments weighing 3.8 grams. These bones are from the blue envelope marked Grave 31.

Grave 31(b)

Sex: unidentifiable
Age: 12-15 years 12+ years (complete maxillary incisor); Under 15 years (incomplete mandibular 2nd molar)
Pathologies: none present

Size weights:
10 mm – 33.4 grams – 69%
5 mm – 14.7 grams – 31%
2 mm – 0 grams – 0%
Total weight: 48.1 grams

Largest fragment: 37 mm (long bone)
Cranial thickness: Majority 4-5 mm (thick diploë), range of 2.5-6 mm
Overall degree of burning: Moderate/High

There are 48.1 grams present from this second assemblage from Grave 31. There are nine cranial fragments weighing 10.7 grams that are dark grey and blue with white and tan markings, most likely from the soil. There are 2 tooth roots, both dark blue/grey in color with white edges. One of the roots is from a 1st maxillary permanent incisor. It could not be ascertained whether the root was complete or not due to a small piece having broken off the end of the root, however it is most likely complete. The other tooth root is a mandibular 2nd molar, with a hole in the tip due to the tooth not having been completely developed. These two roots weigh 0.5 grams. There are 29 dark blue and white long bone fragments weighing 32.9 grams with spiral, transverse, and longitudinal fracturing and nine unidentified fragments weighing 4.0 grams. These remains came from a plastic bag with a tag marked #31.

Grave 32

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 16.0 grams – 40%
5 mm – 22.9 grams – 58%
2 mm – 0.9 grams – 2%
Total weight: 39.8 grams

Largest fragment: 29 mm (long bone)
Cranial thickness: 4 mm
Overall degree of burning: Moderate/High

There is 39.8 grams of bone fragments from this grave. There are 17 cranial fragments that are tan in color with light grey and blue areas and weigh 9.7 grams. There are 23 long bone fragments weighing 23.5 grams with longitudinal and transverse fracturing and are dark grey and blue on the interior side and white on the cortex. There are 24 fragments weighing 6.6 grams that could not be identified which are grey, white, and blue in color. There are also 2 urn fragments weighing 1.9 grams and 11.1 grams of soil.

Grave 33

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 2.4 grams – 100%
5 mm – 0 grams – 0%
2 mm – 0 grams – 0%
Total weight: 2.4 grams

Largest fragment: 35 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: High

There are only 2.4 grams of bone fragments from this grave. There is one bluish-grey cranial fragment weighing 1.0 grams and one long bone fragment weighing 1.4 grams with a black interior and a white exterior. The long bone fragment has longitudinal and transverse fracturing.

Grave 34

Sex: unidentified
Age: 13+ years (proximal ulna, distal humerus); adult (cranial thickness, size of bones)
Pathologies: none present

Size weights:
10 mm – 184.0 grams – 46%
5 mm – 188.4 grams – 47%
2 mm – 29.3 grams – 7%
Total weight: 401.7 grams

Largest fragment: 56 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Low

There are 172 cranial fragments. These bones weigh 74.9 grams and are tan and grey in color. There are two fragments of the left petrous bone and the left and right mandibular condyles. There are two brown vertebral fragments weighing 1.0 grams, one fragment being a portion of the centrum and one being a portion of the vertebral arch. There are 25 rib fragments weighing 5.1 grams and are brown and grey in color. The posterior side of the right patella is present, being brown in color and weighing 2.2 grams. There are 343 brown and grey long bone fragments weighing 225.9 grams. These fragments have longitudinal, transverse, and spiral fracturing with curved, u-shaped breakage. The proximal end of an ulna shaft is present along with the distal end of the humerus. A tan fragment of a talus (side indeterminate) is also present and two warped fragments of either a hand or foot phalanx. These fragments weigh 2.8 grams. There are four tan scapula fragments weighing 2.0 grams and 560+ tan and grey unidentifiable fragments weighing 86.9 grams. There are two animal bones weighing 0.9 grams, one is tan in color and the other is blue; these have been identified as the ribs of either a goat or sheep. There are also 39.8 grams of soil.

Grave 34 (2)

Sex: unidentifiable
Age: 14+ years (fused distal metacarpal/metatarsal, fused proximal phalanx); adult (metacarpal/metatarsal size)
Pathologies: none present

Size weights:
10 mm – 10.2 grams – 8%
5 mm – 82.7 grams – 63%
2 mm – 38.0 grams – 29%
Total weight: 130.9 grams

Largest fragment: Not taken
Cranial thickness: 6-8 mm/3 mm
Overall degree of burning: Moderate

There are 125 cranial fragments weighing 20.2 grams. These fragments range in color, being brown, tan, grey, black, and bluish-white. This is indicative of the bones being exposed to a range of temperatures and heat. There are three large cranial fragments with a cranial thickness of 6-8 mm; however, the rest of the cranial fragments are thin with thickness of 3 mm and are tan and grey in color. This may indicate two individuals, however this is not conclusive as there is no other evidence which would denote two people. These fragments are mainly split between the cranial tables and along the sutures. There are 153 long bone fragments weighing 40.9 grams with longitudinal, transverse, and spiral fracture patterns. These bones are brown and grey-blue in color. There are two light brown vertebral fragments weighing 0.4 grams; these fragments are from cervical vertebrae with articular facets present. There are 19 tan and very thin rib fragments weighing 1.9 grams which are light brown and grey in color. There are 22 scapula fragments which are brown in color and weigh 2.6 grams. There are several fragments of the scapular body and vertebral border present. There are four hand/foot fragments present. One of these is a badly damaged phalanx, one is the fused distal end of either a metatarsal or metacarpal, one is the proximal end of a phalanx and shaft of either a metacarpal or metatarsal. These bones weigh 0.8 grams. There are 700+ unidentified fragments weighing 64.1 grams. There are 11 long bone fragments (2.5 grams) and five unidentifiable bones (0.6 grams) which were taken as a sample. There are also 211.7 grams of rocks, soil, and bone dust.

Grave 35

Sex: unidentifiable
Age: 11+ years (complete permanent maxillary 2^{nd} incisor); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 82.7 grams – 66%
5 mm – 42.2 grams – 33%
2 mm – 1.3 grams – 1%
Total weight: 126.2 grams

Largest fragment: 54 mm (long bone)
Cranial thickness: 4-5 mm
Overall degree of burning: Low

There are 45 cranial fragments weighing 34.9 grams. There is one cranial fragment with a piece of long bone that has been fused onto the interior side of the vault and one cranial fragment that has fused to an unidentifiable fragment. These cranial bones were not separated from the bones they were fused to in order to prevent any breakage. There is one section of the maxilla with damaged tooth sockets and another mandible fragment with green and yellow tinged incisor sockets and one mental spine; however, it could not be determined whether from juvenile or adult due to the degree of burning and postmortem damage. There is one permanent complete maxillary 2nd incisor tooth root present, weighing 0.2 grams. There are 60 long bone fragments present weighing 69.4 grams with longitudinal, spiral, and transverse fracturing. There is one pelvic fragment weighing 1.3 grams, which is mainly spongy bone with weathered cortical edges and there are 63 unidentifiable fragments weighing 20.4 grams. There are 7.8 grams of soil, bone dust, and rocks and two urn fragments weighing 3.0 grams.

Grave 35 (2)

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 40.0 grams – 61%
5 mm – 26.1 grams – 39%
2 mm – 0 grams – 0%
Total weight: 66.1 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Moderate/High

There are 13 cranial fragments with a cranial thickness of 3-4 mm. These fragments weigh 12.7 grams and are white in color. Most of the fragments are split between the cranial tables and along the sutures. There are 58 long bone fragments weighing 53.4 grams which range in colors including tan, black, blue, and grey-white. There is little to no surficial cracking, longitudinal, transverse, and spiral fracturing. Four long bone fragments weighing 2.5 grams were taken as a sample.

Grave 36

Sex: unidentifiable
Age: adult (cranial thickness)

Pathologies: none present

Size weights:
10 mm – 22.2 grams – 76%
5 mm – 7.1 grams – 24%
2 mm – 0 grams – 0%
Total weight: 29.3 grams

Largest fragment: 29 mm (long bone)
Cranial thickness: 4-5 mm
Overall degree of burning: Moderate/High

There are 29.3 grams of bone fragments from this grave. There are seven cranial fragments weighing 8.4 grams that have blue and black interiors and white exteriors. There are 15 dark brown long bone fragments with white edges weighing 18.1 grams with longitudinal, spiral, and transverse fracturing. There are 13 unidentified fragments weighing 2.8 grams and three urn fragments weighing 3.5 grams.

Grave 37

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 24.3 grams – 97%
5 mm – 0.8 grams – 3%
2 mm – 0 grams – 0%
Total weight: 25.1 grams

Largest fragment: 28 mm (long bone, human); 47 mm (patella, cow)
Cranial thickness: N/A
Overall degree of burning: Low/Moderate

There are 25.1 grams of dark brown bone fragments present. Only 7.9 grams of these fragments are human; the other brown fragment is the left patella of a cow weighing 17.2 grams. Of the human bones, there are nine long bone fragments weighing 7.9 grams.

Grave 38 (b)

Sex: unidentifiable
Age: 9+ years (complete molar root); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 24.9 grams – 48%
5 mm – 26.4 grams – 51%
2 mm – 0.5 grams – 1%
Total weight: 51.8 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: 5-7 mm
Overall degree of burning: Moderate/High

There are 25 cranial fragments weighing 11.5 grams which are dark brown in color. The left petrous bone is present. There is one adult molar root with a small fragment of enamel attached weighing 0.4 grams, specific tooth could not be determined. There is one scapula fragment which is white and blue in color and weighs 0.7 grams. It is a portion of the scapular border. There are 53 long bone fragments weighing 35.2 grams. These bones are brown and blue in color, exhibit longitudinal, transverse, and spiral fracturing, and are robust in size. There is one grey phalanx shaft weighing 0.4 grams; however it could not be determined whether this fragment was a portion of a hand or foot phalanx. There are 21 unidentified fragments weighing 3.6 grams which are dark brown and blue in color. There are 2.8 grams of urn fragments and soil.

Grave 38 (2)

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 7.8 grams – 27%
5 mm – 20.6 grams – 70%
2 mm – 1.0 grams – 3%
Total weight: 29.4 grams

Largest fragment: 32 mm (long bone)

Cranial thickness: 4 mm
Overall degree of burning: Moderate/High

There are eight cranial fragments weighing 3.6 grams. These bones are dark brown and black, having been charred with white external coloring in places. There are 33 long bone fragments weighing 22.6 grams with slight surficial cracking, longitudinal, transverse, and spiral cracking, and no warping. These fragments are dark brown in color with small areas of white on the cortical surface. There are 15 unidentified fragments weighing 3.2 grams.

Grave 39

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 7.6 grams – 39%
5 mm – 11.2 grams – 57%
2 mm – 0.7 grams – 3%
Total weight: 19.5 grams

Largest fragment: 26 mm (long bone)
Cranial thickness: 3 mm (without inner cranial table)
Overall degree of burning: Moderate/High

The total weight of bone fragments is 19.5 grams. There are six cranial fragments weighing 2.2 grams that are grey, blue, and white in color. There are 22 long bone fragments weighing 15.3 grams with longitudinal and transverse fracturing that are black, blue, and light grey. There are four unidentified fragments that weigh 2.0 grams. There are also 8.1 grams of soil and 13 urn fragments weighing 13.5 grams. There is also one grey artifact which could not be identified weighing 0.7 grams.

Grave 39 (b)

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 0 grams – 0%
5 mm – 1.3 grams – 48%
2 mm – 1.4 grams – 52%
Total weight: 2.7 grams

Largest fragment: 18 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

There are six long bone fragments present from this assemblage. They weigh 1.4 grams and are tan and grey in color. They exhibit longitudinal, spiral, and transverse fracturing with slight surficial fissuring. There are 22 unidentified fragments weighing 1.2 grams and two brown bone fragments that have been identified as an animal bone; these fragments weigh 0.1 grams. There is 169.1 grams of rocks from this cremation.

Grave 40

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 38.1 grams – 36%
5 mm – 65.1 grams – 61%
2 mm – 3.2 grams – 3%
Total weight: 106.4 grams

Largest fragment: 38 mm (long bone)
Cranial thickness: 3-3.5 mm
Overall degree of burning: Low

There are 22 tan cranial fragments weighing 12.7 grams. Many of these fragments exhibit slight surficial cracking, similar to patina-checking. There are 108 tan and dark grey long bone fragments weighing 87.9 grams with longitudinal, transverse, and spiral fracturing. There are 27 unidentified fragments weighing 5.8 grams that are dark grey and tan in color.

Grave 42

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 9.5 grams – 23%
5 mm – 17.6 grams – 42%
2 mm – 14.5 grams – 35%
Total weight: 41.6 grams

Largest fragment: 28 mm (long bone)
Cranial thickness: 3-5 mm (one 3, one 5)

There are 41.6 grams of bone fragments. There are nine cranial fragments weighing 4.6 grams, 18 long bone fragments weighing 15.0 grams, and 50+ unidentified fragments weighing 22.0 grams. All the fragments are tan and grey in color with the long bone fragments exhibiting longitudinal, spiral and transverse fracturing and deep surficial cracking. There is also 38.5 grams of soil and bone dust.

Grave 43

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 7.6 grams – 29%
5 mm – 15.2 grams – 59%
2 mm – 3.0 grams – 12%
Total weight: 25.8 grams

Largest fragment: 32 mm (long bone)
Cranial thickness: 2 mm (without inner table)
Overall degree of burning: Low

There are 25.8 grams of bone fragments from this grave. There are three cranial fragments weighing 0.9 grams, 23 long bone fragments that weigh 13.9 grams, and 64 unidentified fragments weighing 11.0. All of these fragments are tan, light grey, and blue in color with longitudinal, spiral, and transverse fracturing. There are 13.0 grams of soil and 2.9 grams of 4 urn fragments.

Grave 44

Sex: unidentifiable
Age: adult (cranial thickness, long bone robusticity)
Pathologies: none present

Size weights:
10 mm – 13.5 grams – 62.5%
5 mm – 8.0 grams – 37%
2 mm – 0.1 grams – 0.5%
Total weight: 21.6 grams

Largest fragment: 39 mm (long bone)
Cranial thickness: 5-6 mm
Overall degree of burning: Moderate

There are 21.6 grams of bone fragments. There are seven cranial fragments weighing 6.4 grams that are charred black with a slightly blue exterior. There are 12 long bone fragments weighing 13.1 grams that range in color from dark brown/black to blue to tan. These fragments exhibit longitudinal, spiral, and transverse fracture patterns. There are also five dark brown, blue, and grey unidentified fragments weighing 2.1 grams. Aside from bone fragments, there is one urn fragment weighing 4.1 grams and 31 pieces of charcoal weighing 5.3 grams.

Grave 45

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 29.3 grams – 33%
5 mm – 48.1 grams – 54%
2 mm – 12.4 grams – 13%
Total weight: 89.8 grams

Largest fragment: 32 mm (long bone)

Cranial thickness: 2.5/5 mm
Overall degree of burning: Moderate/High

There are 27 cranial fragments weighing 8.5 grams. There is one cranial fragment with a cranial thickness of 5 mm, with the rest of the fragments being thinner and tan in color (2.5 mm w/o table). There is one vertebral fragment weighing 0.4 grams. This fragment is tan in color and has a portion of the superior articular facet. There are 96 long bone fragments that are mainly white in color with slightly blackened edges. (Bones are moving from blackened/grey phase to white calcined phase but almost calcined, not completely). These fragments have longitudinal, transverse, and spiral fracturing with surficial cracking. These bones weigh 67.2 grams. There are 148 tan and light grey fragments which could not be identified to a specific skeletal element. These fragments weigh 13.7 grams. There are 28.7 grams of urn fragments, soil, and bone dust.

Grave 47

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 75.1 grams – 81%
5 mm – 17.1 grams – 19%
2 mm – 0 grams – 0%
Total weight: 92.2 grams

Largest fragment: 39 mm (long bone)
Cranial thickness: 6-8 mm
Overall degree of burning: Moderate/High

There are 14 cranial fragments from this assemblage. These fragments are very thick fragments, 6 mm with a cranial thickness of over 8 mm. In total, the fragments weigh 22.3 grams and are dark brown, black, and grey with white coloring on the external cortical surface. There is one fragment of the left mandible. There are 42 long bones weighing 65.3 grams which have longitudinal, transverse, and spiral fracture patterns. They are dark brown and black in color with greyish-blue and white edges. There are two unidentified fragments weighing 4.6 grams which are dark brown in color with blue and white edges. There is one red urn fragment weighing 6.6 grams and 9.9 grams of soil.

Grave 49

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 20.6 grams – 55%
5 mm – 17.1 grams – 45%
2 mm – 0 grams – 0%
Total weight: 37.7 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Moderate/High

The total bone weight is 37.7 grams. There are 36 long bone fragments weighing 33.3 grams with a dark blue interior and calcined white exterior. These bones exhibit longitudinal, spiral, and transverse fracturing. The remaining fragments are comprised of 11 unidentified fragments weighing 4.4 grams. There are also two urn fragments weighing 6.3 grams.

Grave 50

Sex: unidentifiable
Age: 15-16+ years (fused head of humerus or femur); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 57.3 grams – 81%
5 mm – 13.3 grams – 18.7%
2 mm – 0.2 grams – 0.3%
Total weight: 70.8 grams

Largest fragment: 33 mm (long bone, cranium)
Cranial thickness: 5-8 mm

Overall degree of burning: High

There are 23 cranial fragments weighing 37.6 grams. These fragments range in cranial thickness of 5 mm to 8 mm. The left petrous is present. The bones are blue and white in color and are split along the sutures and diploë, some not separated between tables. There are 25 long bone fragments weighing 30.7 grams which are blue and white in color and have longitudinal, transverse, and spiral fracturing. A fragment of either fused femoral or humeral head is present. There are five unidentified white calcined fragments which weigh 2.5 grams. A sample of 2 unidentified and 6 long bone fragments weighing 5.0 grams were taken.

Grave 51

Sex: unidentifiable
Age: adult (cranial thickness, moderately closed suture)
Pathologies: none present

Size weights:
10 mm – 36.6 grams – 65%
5 mm – 19.2 grams – 34%
2 mm – 0.3 grams – 1%
Total weight: 56.1 grams

Largest fragment: 34 mm (long bone)
Cranial thickness: 5-8 mm
Overall degree of burning: Low/Moderate

There are 15 dark brown cranial fragments weighing 9.0 grams with a cranial thickness of 5-8 mm. There is one fragment with a moderately closed suture, indicating an older individual. There are 31 long bone fragments weighing 44.5 grams. These fragments exhibit longitudinal, transverse, and spiral fracturing with slight surficial cracking. There are 11 unidentified fragments weighing 2.6 grams which are blackened and charred. Two long bone fragments weighing 2.5 grams were taken for a sample.

Grave 52

Sex: unidentifiable

Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 22.0 grams – 44%
5 mm – 27.9 grams – 56%
2 mm – 0 grams – 0%
Total weight: 49.9 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: 3.5-4.5 mm
Overall degree of burning: Low

There are 49.9 grams of cremains from this grave. There are five cranial fragments weighing 3.4 grams. These fragments have a white exterior and blue diplöe, with tan coloration in places. There are 45 long bone fragments weighing 42.8 grams with spiral, longitudinal, and transverse fractures. The majority of these fragments are tan in color, with some being blackened. There are 10 tan and blue-grey fragments weighing 3.7 grams that could not be identified. There are also 0.7 grams of soil.

Grave 53

Sex: female?
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 80.2 grams – 62%
5 mm – 48.4 grams – 37%
2 mm – 0.8 grams – 1%
Total weight: 129.4

Largest fragment: 42 mm (long bone)
Cranial thickness: 5-6 mm
Overall degree of burning: Moderate

There are 16 cranial fragments weighing 22.0 grams. These fragments are tan, blue, and grey in color. There are three scapula fragments weighing 1.2 grams; two of the fragments are from the body and one is from the lateral border. These fragments are grey and blue in color. There are 85 long bone fragments with u-shaped, longitudinal, transverse, and spiral fracturing with little to no surficial fissuring. These bones weigh 95.2 grams. There is also a pelvic fragment weighing 3.6 grams which is blue in color. It is a fragment of the greater sciatic notch and appears to be wide, indicating a female individual; however a portion of it is broken so this conclusion cannot be made with complete accuracy. There are nine tan and blue fragments weighing 4.8 grams which could not be assigned to a specific category of skeletal element. There is one grey animal fragment (right mandible) weighing 2.6 grams.

Grave 56

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 105.9 grams – 60%
5 mm – 69.8 grams – 39.5%
2 mm – 0.7 grams – 0.5%
Total weight: 176.4 grams

Largest fragment: 40 mm (cranium)
Cranial thickness: 5-7 mm
Overall degree of burning: Moderate

There are 35 cranial fragments weighing 55.3 grams which have a general thickness of 5 mm to 7 mm. They are mainly unsplit between the cranial tables, with only two having both cranial tables connected. The bones are both blackened and calcined with slight surficial fissuring and cracking. There is fragmented portion of either the maxilla or the mandible with two single root tooth sockets. There are 105 long bone fragments which have longitudinal, transverse, and spiral fracturing and slight surficial fissuring. These fragments are black and dark blue on the internal side, white and calcined on the exterior side. These fragments weigh 113.8 grams. There is one tan and slightly blue vertebral fragment; it is the dens of the axis (2nd cervical vertebra) and is 1.6 grams in weight. There is one white scapula fragment weighing 0.6 grams and there are 11 unidentified fragments weighing 5.1 grams. Three long bone fragments weighing 5.4 grams were taken for a sample.

Grave 57

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 21.6 grams – 58%
5 mm – 15.9 grams – 42%
2 mm – 0 grams – 0%
Total weight: 37.5 grams

Largest fragment: 32 mm (long bone)
Cranial thickness: 3.5 mm (without inner table)
Overall degree of burning: Low

The total weight from this grave is 37.5 grams. There are seven cranial pieces weighing 5.8 grams. One of the fragments is a portion of the maxilla with three small tooth sockets. Judging from the diminutive size of the tooth sockets, this may be the remains of a juvenile individual, although there is not enough information present to make an accurate determination of age based on the dentition. There is dirt filling the tooth sockets but it was not removed in order to prevent possible breakage of the fragment. There is one vertebral fragment weighing 1.5 grams. It is light blue in color unlike the rest of the assemblage which is tan in color. It is from a vertebra with the beginning of the vertebral spine and both inferior articular facets on either side. This is most likely from the 12th thoracic or 1st lumbar vertebrae, as all other vertebrae do not have inferior articular facets so close to the neural process of the vertebra. There is one scapula fragment which weighs 0.3 grams, is white in color, and is a border fragment. There are 20 long bone fragments weighing 28.1 grams with longitudinal and transverse fracturing and five light tan unidentified fragments weighing 1.8 grams.

Grave 58

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 37.4 grams – 52%
5 mm – 35.1 grams – 48%
2 mm – 0 grams – 0%
Total weight: 72.5 grams

Largest fragment: 46 mm (long bone)
Cranial thickness: 3 mm
Overall degree of burning: Low

There are nine brown cranial fragments weighing 7.0 grams. The thickest cranial fragment is 3 mm. One of the fragments is split between the cranial tables; the rest are not. There are 57 long bone fragments weighing 63.4 grams and are brown in color with spiral, transverse, and longitudinal fracturing. These fragments do not exhibit any surficial cracking. There is one clavicle fragment weighing 1.5 grams which is brown in color. There are two brown fragments weighing 0.6 grams that could not be assigned to a specific skeletal element. There are also 15.9 grams of rocks.

Grave 59

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 21.6 grams – 65%
5 mm – 11.4 grams – 35%
2 mm – 0 grams – 0%
Total weight: 33.0 grams

Largest fragment: 55 mm (long bone)
Cranial thickness: 2.5-3 mm (without inner table)
Overall degree of burning: Low

There are five light brown cranial fragments which weigh 4.1 grams and have split between the cranial tables. There are 33 long bone fragments weighing 28.6 grams, with longitudinal, transverse, and spiral fracturing and are dark brown and bluish-grey in color. There are eight unidentifiable fragments weighing 0.3 grams. There are also two red urn fragments weighing 12.8 grams.

Grave 60

Sex: unidentifiable
Age: 16+ years (distal tibia); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 79.8 grams – 82%
5 mm – 17.9 grams – 18%
2 mm – 0 grams – 0%
Total weight: 97.7 grams

Largest fragment: 39 mm (long bone)
Cranial thickness: 5-6 mm
Overall degree of burning: Moderate/High

There are 25 tan cranial fragments weighing 38.4 grams. These fragments are not split between the cranial tables; however, many fragments have split between the sutures. There is one fragment which has a green coloration due to being in contact with a bronze artifact. One of the cranial fragments has a cranial thickness of 6 mm, which is generally characteristic of an adult individual. There are 24 long bone fragments weighing 41.6 grams which are grey and blue in color with slight white coloration on the edges. These long bone fragments exhibit longitudinal, transverse, and spiral fracturing. There is one fragment which has the greenish-blue coloration which is attributed to having been in contact with bronze. One of the long bone fragments has been identified as the fused distal end of the tibia with a portion of the inferior articular surface present. There are six thick rib fragments which weigh 5.9 grams and are bluish-grey in color. There is one fragment of the talus, the superior articular surface, which weighs 4.3 grams. There are five fragments which could not be identified and weigh 7.5 grams. These fragments are mainly dark grey and blue and are comprised of cancellous bone. There is also one brown urn fragment and soil weighing 12.4 grams.

Grave 61

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 40.1 grams – 61%
5 mm – 25.2 grams – 38%
2 mm – 0.5 grams – 1%
Total weight: 65.8 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low/Moderate

There are 11 cranial fragments; these fragments are tan in color with slight blue and white areas. They are also both split and unsplit between the cranial tables and weigh 10.4 grams. There are 35 long bone fragments weighing 50.0 grams with longitudinal, transverse, and spiral fracturing and are white in color. There are two scapula fragments weighing 2.2 grams; one of the fragments is a portion of the lateral border and both bones are tan and grey in color. There are 13 unidentifiable fragments weighing 3.2 grams and are tan and blue in color.

Grave 62

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 19.6 grams – 57%
5 mm – 14.0 grams – 40%
2 mm – 1.0 grams – 3%
Total weight: 34.6 grams

Largest fragment: 26 mm (long bone)
Cranial thickness: 5-8 mm
Overall degree of burning: High

The total weight of bone fragments from this assemblage is 34.6 grams. There are 14 cranial fragments weighing 13.5 grams, 8 long bone fragments weighing 10.6 grams, and 24 unidentified fragments weighing 10.5 grams. The bone fragments are calcined white and bluish-grey with longitudinal, spiral, u-shaped, and transverse fracturing. There is also one quartz fragment that weighs 2.6 grams.

Grave 63

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 47.8 grams – 89%
5 mm – 6.0 grams – 11%
2 mm – 0 grams – 0%
Total weight: 53.8 grams

Largest fragment: 48 mm (long bone)
Cranial thickness: 5-6 mm
Overall degree of burning: Moderate

Total weight of this assemblage is 53.8 grams. There are eight cranial fragments with a blackened interior and calcined white exterior weighing 18.2 grams. There are 28 long bone fragments weighing 35.4 grams that are dark black on the interior side, white on the exterior, with several tan fragments. There are two unidentified fragments weighing 0.2 grams and 1.7 grams of soil.

Grave 65

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 7.7 grams – 58%
5 mm – 5.0 grams – 38%
2 mm– 0.5 grams – 4%
Total weight: 13.2 grams

Largest fragment: 23 mm (long bone)
Cranial thickness: 4-5 mm
Overall degree of burning: High

The total bone weight from this grave is 13.2 grams. There are five cranial fragments weighing 5.3 grams, with the internal side being blue and the external being white. Three of the cranial fragments are fragments of the petrous bones. There are eight white and grey long bone fragments weighing 5.6 grams with longitudinal, spiral, and transverse fracturing, and nine white and grey unidentified fragments weighing 2.3 grams. There is also one urn fragment weighing 0.3 grams.

Grave 68

Sex: unidentifiable
Age: 15+ years (complete maxillary 2nd incisor, canine sockets)
Pathologies: none present

Size weights:
10 mm – 20.1 grams – 40%
5 mm – 29.6 grams – 59%
2 mm – 0.3 grams – 1%
Total weight: 50.0 grams

Largest fragment: 37 mm (long bone)
Cranial thickness: 2 mm
Overall degree of burning: Moderate/High

The total weight from this grave is 50.0 grams. There are six cranial fragments weighing 4.2 grams, one fragment being a portion of the maxilla with two complete single root tooth sockets. The tooth sockets appear to be the sockets of the 2nd maxillary incisor and canine from right side. There are 31 light grey and tan long bone fragments weighing 31.8 grams, and 27 unidentified fragments weighing 13.0 grams. There are two scapula bones which are light grey in color, weigh 1.0 grams, and are a portion of the scapular border. There is also one fragment weighing 1.4 grams that is severely charred to the point that the author could not make a definitive identification on whether the fragment was actually bone or not and was not added into the overall weight of the cremation.

Grave 68 (2)

Sex: unidentifiable
Age: 9+ years (permanent maxillary 1st molar); 12+ years (permanent mandibular 1st premolar); 17+ years (glenoid fossa)
Pathologies: none present

Size weights:
10 mm – 20.4 grams – 9%
5 mm – 111.8 grams – 49%
2 mm – 94.5 grams – 42%
Total weight: 226.7 grams

Largest fragment: 28.5 mm (cranium, unidentifiable)
Cranial thickness: 3 mm
Overall degree of burning: Low/Moderate

There are 120 cranial fragments weighing 31.7 grams. These are small, thin fragments, tan and blue-grey in color, and which are both separated and unseparated between the cranial tables. There are three tooth fragments, one tooth having broken in half. One tooth root is of a permanent mandibular 1st premolar and the other is a complete molar root, from a 1st maxillary molar. These fragments are blue in color and weigh 0.4 grams. There is one rib fragment weighing 0.5 grams which is tan and grey in color. There are 11 scapula fragments weighing 4.7 grams. There is a fragment of the glenoid fossa, a fragment of the body, and a fragment of the vertebral border. These fragments are tan and grey in color. There are 194 long bone fragments weighing 61.3 grams. They are tan, black, and grey-blue in color with longitudinal, transverse, and spiral fracturing.

There is slight surficial cracking on the exterior side of the bones. There are 1477 unidentified fragments weighing 128.1 grams. There are also 84.1 grams of soil and bone dust.

Grave 70

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 29.4 grams – 40%
5 mm – 40.9 grams – 57%
2 mm – 2.4 grams – 3%
Total weight: 72.7 grams

Largest fragment: 33 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low/Moderate

There are 24 cranial fragments weighing 20.2 grams. These fragments vary in cranial thickness between 3-4 mm and are tan in color with slightly blue-grey edges. There are 57 long bone fragments weighing 46.5 grams that have longitudinal, transverse, and spiral fracturing with external cortical fissuring. Many of these fragments are tan with blackened interiors and dark blue-grey scorching; others are completely calcined. There are 43 unidentified fragments weighing 6.0 grams that are tan and dark blue in color. There are 34.1 grams of soil, rocks, urn fragments, and bone dust.

Grave 70 (2)

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 10.3 grams – 45%
5 mm – 12.8 grams – 55%
2 mm – 0 grams – 0%
Total weight: 23.1 grams

Largest fragment: 27 mm (long bone)
Cranial thickness: 3.5 mm
Overall degree of burning: Low/High

There are 23.1 grams present from this grave. There are 10 cranial fragments weighing 8.3 grams that are tan in color with grey edges. There are 12 long bone fragments that are light tan and weigh 7.5 grams with longitudinal, spiral, and transverse fracturing. There are 12 unidentified fragments weighing 7.3 grams. These fragments are light grey, tan, and white in color, with many being too calcined to allow for identification. There are also 4.0 grams of soil.

Grave 72

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 22.6 grams – 50%
5 mm – 22.2 grams – 49%
2 mm – 0.8 grams – 1%
Total weight: 45.6 grams

Largest fragment: 34 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Moderate/High

There are 45.6 grams of bone fragments present. There are seven grey cranial fragments weighing 4.5 grams, 46 long bone fragments weighing 35.8 grams, and 14 unidentified fragments weighing 3.5 grams. There is one white fragment of the scapular body weighing 0.2 grams. The long bone fragments exhibit longitudinal, transverse, spiral, and u-shaped fracturing. The unidentified fragments are blue and black in color with a chalky white, calcined exterior and are mainly cancellous bone. There are also four rocks that weigh 5.4 grams and four animal long bone fragments which weigh 1.6 grams. These animal bones appear to be unburned.

Grave 73

Sex: unidentifiable
Age: 11+ years (permanent maxillary 1st incisor); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 44.6 grams – 74%
5 mm – 15.1 grams – 25%
2 mm – 0.4 grams – 1%
Total weight: 60.1 grams

Largest fragment: 34 mm (rib)
Cranial thickness: 5-6 mm
Overall degree of burning: Moderate

There are eight cranial fragments weighing 10.6 grams which are tan in color and are both split and unsplit between the cranial tables. There is one fragment of an adult maxillary 1st incisor, weighing 0.2 grams, and is blue and white in color. There is one tan rib fragment weighing 0.8 grams. There are 32 long bone fragments with spiral, longitudinal, and transverse fracturing and slight surficial cracking. These bones are tan and grey-blue in color and weigh 41.8 grams. There are also several green bronze fragments adhering to the long bone fragments. There are 11 unidentified fragments that are brown and grey-blue in color and weigh 6.7 grams. There are 26.5 grams of urn fragments and soil. A fragment of bronze is also adhering to a rock.

Grave 77

Sex: unidentifiable
Age: 8+ years (permanent mandibular 1st molar); 15+ years (permanent maxillary canine, maxillary 1st premolar, maxillary 2nd premolar)
Pathologies: none present

Size weights:
10 mm – 84.0 grams – 22%

5 mm – 191.2 grams – 50%
2 mm – 110.3 grams – 28%
Total weight: 385.5 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: 2.5 mm
Overall degree of burning: High

The total bone weight from this grave is 385.5 grams. There are 241 white cranial fragments weighing 115.1 grams with 10 tooth roots or tooth root fragments weighing 1.3 grams (white maxillary 2nd premolar root, tip broken off, adult maxillary 1st premolar, white; both tips broken off; root of adult maxillary canine, root broken but complete; white 1st permanent mandibular molar, one root broken away, the other root broken in half; portion of another molar, and then 5 additional fragments unidentifiable to specific tooth; all fragments white). There are 221 white and grey long bone fragments weighing 127.1 grams with longitudinal, spiral, and transverse and 1268 fragments weighing 142.0 grams that could not be identified. There are three fragments of bronze that were found with the remains which weigh 0.3 grams.

There are also two matchboxes, one red and one white. The red matchbox contains 12.6 grams of fragments: skull (1, 0.6 grams, white) long bones (31, white, 10.2 grams), adult complete tooth root (mandibular 1st incisor, white, 0.1 grams) and unidentified fragments (9, 1.7 grams, white and blue) and the white matchbox contains a clump of soil with a small bronze fragment attached weighing 2.6 grams. There are five large red urn fragments and charcoal which weigh 35.6 grams and soil and bone dust weighing 91.3 grams. Three bronze fragments weighing 0.4 grams.

Pobrežje

Grave 1

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 35.2 grams – 63%
5 mm – 19.9 grams – 35%
2 mm – 1.2 grams – 2%
Total weight: 56.3 grams

Largest fragment: 43 mm (cranium)
Cranial thickness: 3.5-5mm (split between tables)
Overall degree of burning: Low

There are 20 brown cranial fragments weighing 22.7 grams. There are 29 long bone fragments weighing 24.8 grams. These fragments are dark brown in color with longitudinal, spiral, and transverse fracturing with edge curling. There is one brown pelvis fragment weighing 3.5 grams which is from the right innominate bone. There is one brown scapula fragment weighing 0.7 grams. There is one dark brown fragment weighing 0.9 grams which is a fragment of a pig maxilla. There are also 28 unidentifiable fragments weighing 3.7 grams.

Grave 3

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 27.7 grams – 86%
5 mm – 4.3 grams – 13%
2 mm – 0.3 grams – 1%
Total weight: 32.3 grams

Largest fragment: 58 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Low

There are 32.3 grams from this assemblage. There are seven dark brown and grey cranial fragments weighing 6.2 grams and 14 brown long bone fragments weighing 20.2 grams. The shaft of the radius, ulna, or fibula is present; these long bone fragments exhibit longitudinal, spiral, and transverse fracturing with slight warping. There is one fragment which is a portion of the scapula weighing 1.1 grams and 12 unidentified fragments weighing 4.8 grams. There are also 8.9 grams of soil.

Grave 14

Sex: unidentifiable
Age: 14+ years (fused phalanx); 16+ years (iliac crest)
Pathologies: none present

Size weights:
10 mm – 120.5 grams – 75%
5 mm – 37.3 grams – 23%
2 mm – 2.5 grams – 2%
Total weight: 160.3 grams

Largest fragment: 56 mm (long bone)
Cranial thickness: 4 mm
Overall degree of burning: Low

There are 25 cranial fragments weighing 44.2 grams. These fragments are light brown in color and are split between the diploë and the sutures. There is a fragment of the maxilla with single-root tooth sockets. There are 55 dark brown and grey long bone fragments weighing 93.5 grams with longitudinal, transverse, and spiral fracturing and minimal surficial cracking. There are four vertebral fragments weighing 3.5 grams that are light grey and brown in color. Two of the fragments have articular facets, one is a fragment of a cervical body, and the other is a portion of a centrum. There are 0.4 grams of hand and foot bones; one is a pisiform and the other is a fragment of a proximal end of a distal phalanx (whether hand or foot could not be determined). There are two pelvic fragments, both being brown in color and being fragments of the iliac crest. These fragments weigh 2.4 grams. There are 59 unidentifiable fragments weighing 16.3 grams which are tan and grey in color. There are 22.1 grams of soil, rocks, and bone dust.

Grave 19

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 45.4 grams – 31%
5 mm – 86.9 grams – 59%
2 mm – 13.8 grams – 10%
Total weight: 146.1 grams

Largest fragment: 40 mm (long bone)
Cranial thickness: 7-8 mm (2 fragments); 2-3 mm (remaining bones)
Overall degree of burning: High

There are 52 cranial fragments weighing 25.2 grams; these fragments are white and dark grey in color and are mainly split between the cranial tables. There are 179 long bone fragments weighing 98.4 grams; these fragments are white and grey in color with longitudinal, transverse, and spiral fracturing; there is minimal surficial cracking on a few fragments. There is one rib fragment weighing 0.1 grams which is dark grey and white in color. There are 156 unidentified fragments weighing 22.4 grams which are dark grey, blue, and white in color.

Grave 26

Sex: unidentifiable
Age: 15+ years (distal radius); 20+ years (fused epiphyseal ring)
Pathologies: spinal degeneration

Size weights:
10 mm – 299.2 grams – 71%
5 mm – 106.4 grams – 25%
2 mm – 14.8 grams – 4%
Total weight: 420.4 grams

Largest fragment: 60 mm (long bone)
Cranial thickness: 4.5-5 mm
Overall degree of burning: Moderate/High

There are 35 tan fragments weighing 78.0 grams. There is portion of the occipital bone with separation having occurred on the lambdoidal suture. The right coronoid process from the right mandible is also present. There are four vertebral fragments weighing 9.1 grams that are light brown in color. There is the fused centrum of a lumbar vertebra with slight lipping which is likely due to spinal degeneration. There is a portion of a vertebral body, a fragment exhibiting an articular facet, and a portion of the right side of the atlas with lamina and facet present. There are 221 long bone fragments weighing 249.3 grams which are beige in color and have u-shaped, longitudinal, spiral, and transverse fracturing. One of the fragments is the fused distal end of a radius. There are eight tan fragments weighing 6.2 grams. One of the fragments is the sternal end which is not pitted and has a slightly rough edge. There are six scapula fragments weighing 4.4 grams which are tan in color. There are four foot fragments; a portion of the trochlea from the talus, a navicular, the distal end of a 1st metatarsal, and the proximal end of a metatarsal. These fragments weigh 5.2 grams. There are 344 unidentified fragments weighing 68.2. There are also 80.3 grams of soil and bone dust.

Grave 27

Sex: female (preauricular sulcus)
Age: 15+ years (permanent maxillary 1st premolar); 21-30 years (auricular surface); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 107.4 grams – 82%
5 mm – 22.7 grams – 17%
2 mm – 0.6 grams – 1%
Total weight: 130.7 grams

Largest fragment: 60 mm (long bone)
Cranial thickness: 5-6 mm
Overall degree of burning: High

There are 13 cranial fragments weighing 17.7 grams. These bones are dark grey and white in color. Both the left and right petrous bones are present. There is one tooth root present; it is the root of a permanent complete 1st maxillary premolar and weighs 0.4 grams. There is one vertebral fragment weighing 0.7 grams which is tan in color and is a fragment of a vertebral body. There are two pelvic fragments weighing 5.6 grams. One fragment is a portion of the right ilium with a smooth auricular surface and a deep preauricular sulcus. The smoothness of the auricular surface provides an estimated age range of 21-30 and the deep, narrow preauricular sulcus is typical of a female individual. It is dark brown in color. The other pelvic fragment is blue in color and is a portion of the acetabulum. There are 63 dark grey and white long bone fragments weighing 96.7 grams. There is a fragment of the ulna shaft. These bones exhibit longitudinal, transverse, and spiral fracturing with no surficial cracking. There are 24 unidentified fragments weighing 8.7 grams which are dark brown and blue in color. There is one animal fragment which weighs 0.9 grams and is blue in color. There are 22.2 grams of soil and bone dust.

Grave 32

Sex: unidentifiable
Age: 13+ years (proximal radius, distal humerus); 14+ years (distal metatarsal)
Pathologies: none present

Size weights:
10 mm – 113.1 grams – 78%
5 mm – 26.1 grams – 18%
2 mm – 5.4 grams – 4%
Total weight: 144.6 grams

Largest fragment: 66 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low

There are ten cranial fragments weighing 14.0 grams which are light brown and grey in color and are broken along the sutures and between cranial tables. There is one fragment of the occipital bone. There is one tan rib fragment weighing 0.7 grams. There is one vertebral fragment weighing 4.2 grams. This fragment is the dens of the axis. There are 71 long bone fragments weighing 102.4 grams, including the fused proximal end of the right radius with the bicep tuberosity, and the fused distal end of the left humerus. These fragments exhibit longitudinal, transverse, and spiral fracturing with no surficial cracking. They are tan in color with green coloration typical of bronze contact with one of the shaft fragments. There are three hand/foot bones. There are three metatarsal/metacarpal shaft fragments; one shaft fragment is from a metatarsal and has the fused distal end. These fragments weigh 2.3 grams and are tan and grey in color. There are two tan scapula fragments weighing 5.8 grams; one of the fragments is a portion of the lateral border. There are 115 unidentified fragments weighing 15.2 grams and 35.9 grams of bone dust.

Grave 36

Sex: male (browridge, supraorbital margin)
Age: 12+ years (complete mandibular incisor sockets); 13+ years (distal humerus); 14+ years (distal metacarpal/tarsal, distal 2nd metatarsal); 15+ years (distal radius, ulna); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 246.6 grams – 80%
5 mm – 56.8 grams – 18%
2 mm – 4.5 grams – 2%
Total weight: 307.9 grams

Largest fragment: 73 mm (long bone)
Cranial thickness: 4-6 mm (with both tables); 3 (with only one table)
Overall degree of burning: Low

There are 15 cranial fragments weighing 15.3 grams. One of the fragments is an adult left mandibular condyle and a fragment of the frontal bone with a large browridge and a rounded supraorbital margin, which is are typically male characteristics. There is also a fragment of the mandible with the mental spines and the tooth sockets of the four adult mandibular incisors. These fragments are tan and grey in color and there is an approximate cranial thickness of 5 mm. There are 107 long bone fragments weighing 223.7 grams with longitudinal, transverse, and spiral fracturing. There is the fused distal end of a humerus, the fused distal end of an ulna with styloid process and the distal end of a radius. These long bone fragments have slight warping and are tan and brown in color with blue and white edges. There are three rib fragments which weigh 0.4 grams and are tan in color. There is one tan fragment of the anterior side of a patella weighing 1.6 grams. There is one vertebral fragment weighing 0.3 grams which is tan and grey in color. There are six tan scapula fragments weighing 7.1 grams. There are eight foot fragments and one either foot or hand fragment weighing 15.9 grams. These fragments include the left and right naviculars, a lateral cuneiform, the trochlea of the right talus, an intermediate cuneiform, the fused distal head of either a metatarsal or metacarpal, the distal end of a 1st metatarsal, and the distal ends of the 1st and 2nd metatarsals. There are 105+ unidentifiable fragments which are tan and dark grey in color and weigh 43.6 grams.

Grave 39

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: cranial pitting (porotic hyperostosis)

Size weights:
10 mm – 102.0 grams – 81%
5 mm – 23.4 grams – 19.5%
2 mm – 0.5 grams – 0.5%
Total weight: 125.9 grams

Largest fragment: 56 mm (long bone)
Cranial thickness: 3-4 mm (split between diploë)
Overall degree of burning: Low

There are 15 cranial fragments weighing 19.4 grams. One of the fragments exhibits slight cranial pitting. There are 58 tan long bone fragments weighing 98.8 grams. The long bone fragments exhibit longitudinal, transverse, and spiral fracturing. There is one tan rib fragment weighing 0.7 grams and 22 unidentifiable fragments weighing 7.0 grams. There are 5.0 grams of soil.

Grave 55

Sex: unidentifiable
Age: 13+ years (proximal radius)
Pathologies: none present

Size weights:
10 mm – 28.4 grams – 64%
5 mm – 14.6 grams – 33%

2 mm – 1.5 grams – 3%
Total weight: 44.5 grams

Largest fragment: 71 mm (long bone)
Cranial thickness: 3-4 mm (split between tables)
Overall degree of burning: Low

There are 32 tan cranial bones weighing 15.0 grams. There are 42 long bone fragments weighing 23.6 grams. There is the fused head of a radius. The bones are tan in color and exhibit longitudinal, transverse, and spiral fracturing, with splintering, warping, and curling of the fragments. There are also two shaft fragments from the fibula, ulna, or radius. There are 44 tan unidentifiable fragments weighing 5.9 grams. There are also 24.3 grams of soil.

Grave 56

Sex: unidentifiable
Age: adult (cranial thickness, scapula robusticity)
Pathologies: none present

Size weights:
10 mm – 19.4 grams – 52%
5 mm – 17.0 grams – 46%
2 mm – 0.6 grams – 2%
Total weight: 37.0 grams

Largest fragment: 39 mm (long bone)
Cranial thickness: 5mm (split between tables)
Overall degree of burning: Low

There are 37.0 grams of bone fragments present from this grave. There are 12 tan cranial fragments weighing 8.8 grams which are split along the diploë, separating the inner and outer tables. There is one tan rib fragment weighing 0.3 grams. There is one tan and grey scapula fragment (thick body portion near superior part) which weighs 1.6 grams. There are 21 tan long bone fragments weighing 14.1 grams with longitudinal and transverse fracturing and warping of the thinner pieces. There is also a portion of the left? (trochlea) talus weighing 3.3 grams which is light brown in color. There are 34 unidentified fragments weighing 8.2 grams. There are two fragments weighing 0.7

grams which have been identified as animal bones. There are also 4.1 grams of soil and three urn fragments weighing 4.3 grams.

Grave 57

Sex: unidentifiable
Age: 14+ years (proximal phalanx); 15+ years (femoral head); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 214.6 grams – 71%
5 mm – 76.5 grams – 25%
2 mm – 11.2 grams – 4%
Total weight: 302.3 grams

Largest fragment: 62 mm (long bone)
Cranial thickness: 4-5 mm
Overall degree of burning: Low/Moderate

There are 58 cranial bones weighing 79.7 grams with cranial thickness of 5 mm. There are two pieces of the right petrous bone which broke during cleaning. These cranial bones are tan, black, and dark blue in color. There are 11 tan rib fragments which weigh 3.0 grams. There is one patella fragment; this fragment weighs 2.6 grams and is the posterior side of the right patella. There are seven scapula fragments weighing 7.8 which are tan in color with dark blue edges. There are three vertebral fragments weighing 1.2 grams. There is a portion of the body and a fragment with an articular facet and pedicle. These fragments are tan in color. There are two tan pelvis fragments weighing 1.5 grams. There are 128 light brown long bone fragments weighing 155.9 grams that exhibit longitudinal, transverse, and spiral fracturing. There is an adult femoral head with fovea capitis and three fragments of the heads of humerii. These fragments are tan, dark brown, grey, and blue in color. There are two tan hand/foot bones weighing 0.7 grams; these include the fused proximal end of a proximal hand phalanx and the proximal end of either a metacarpal or metatarsal. There are 290+ unidentified fragments weighing 44.6 grams which are tan, brown, and dark blue in color. There are 141.3 grams of soil and bone dust. There are also two animal bones: the distal epiphysis of femur of red deer (4.1 grams) and the maxilla of a juvenile pig (1.2 grams). These bones are brown and grey in color.

Grave 59

Sex: unidentifiable
Age: 15+ years (distal humerus)
Pathologies: none present

Size weights:
10 mm – 74.3 grams – 78%
5 mm – 19.3 grams – 20%
2 mm – 2.3 grams – 2%
Total weight: 95.9 grams

Largest fragment: 36 mm (long bone)
Cranial thickness: 4.5-5 mm
Overall degree of burning: Low

There are 43 tan cranial fragments weighing 39.0 grams. There is one small mandibular condyle, side indeterminate. There is one rib fragment weighing 0.3 grams which is greenish-grey in color, most likely due to soil staining. There is one beige vertebral fragment weighing 0.7 grams which is a portion of a centrum with pedicle. There is one tan clavicle fragment weighing 1.5 grams. There are 46 long bone fragments weighing 44.8 grams; these fragments include a fragment of the right ulna with the ulna tuberosity and the fused distal end of the right humerus with the capitulum and trochlea present. There are the left and right distal heads of the 1st metatarsals which weigh 2.6 grams and are brown in color. There are 52 unidentifiable fragments weighing 7.0 grams.

Grave 61

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:

10 mm – 11.8 grams – 77%
5 mm – 3.4 grams – 22%
2 mm – 0.1 grams – 1%
Total weight: 15.3 grams

Largest fragment: 40 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

There are 11 long bone fragments weighing 14.0 grams which are tan in color and exhibit longitudinal and transverse fracturing with shallow surficial cracking. There are two tan scapula fragment weighing 1.1 grams; both are fragments of the scapular body. There are three unidentifiable fragments which weigh 0.2 grams and are tan with white edges. There are 5.2 grams of rocks and three urn fragments weighing 1.7 grams.

Grave 63

Sex: unidentifiable
Age: adult (robusticity of humerus shaft; size of femoral head fragment)
Pathologies: none present

Size weights:
10 mm – 118.6 grams – 91%
5 mm – 11.6 grams – 8.8%
2 mm – 0.3 grams – 0.2%
Total weight: 130.5 grams

Largest fragment: 82 mm (long bone, humerus shaft)
Cranial fragments: 3 mm (split between tables)
Overall degree of burning: Low

There are three cranial fragments weighing 2.8 grams which are dark grey in color and both split and unsplit along the diploë. There are 38 light brown long bone fragments with longitudinal and transverse fracturing, edge curling, and slight surficial cracking. These fragments weigh 109.2 grams. One of the fragments is a portion of an adult femoral head. There are two dark grey patella fragments; both are fragments of the lateral facets from the left and right patella and they weigh 6.2 grams. There is one intermediate cuneiform which is light brown in color and weighs 1.0 grams. There are

14 unidentified fragments weighing 11.3 grams which are dark brown in color and comprised of mainly spongy bone. There is 16.0 grams of soil, charcoal, and bone dust.

Grave 63 (2)

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 4.5 grams – 49%
5 mm – 4.7 grams – 51%
2 mm – 0 grams – 0%
Total weight: 9.2 grams

Largest fragment: 30 mm (cranium)
Cranial thickness: 3.5-4 mm (split between tables)
Overall degree of burning: Low

These bones were in a separate bag in the envelope containing the bones from Grave 63. There are ten tan, grey, and white cranial bones weighing 5.3 grams and five white long bone fragments weighing 1.6 grams with longitudinal, transverse, and spiral fracturing. There are ten brown and grey unidentifiable fragments weighing 2.3 grams.

Grave 66

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 0 grams – 0%
5 mm – 3.5 grams – 90%
2 mm – 0.4 grams – 10%
Total weight: 3.9 grams

Largest fragment: 15.5 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low/High

There are only 3.9 grams of bone fragments present from this grave. There are nine long bone fragments weighing 3.2 grams which are tan and white in color and exhibit longitudinal, spiral, and transverse fractures. There are four tan fragments which could not be identified which weigh 0.7 grams and 2.7 grams of soil.

Grave 68

Sex: unidentified
Age: 11+ years (complete incisor socket); 13+ years (fused proximal ulna); 17+ years (fused glenoid fossa); 20+ years (fused vertebral body)
Pathologies: none present

Size weights:
10 mm – 129.1 grams – 73%
5 mm – 45.0 grams – 26%
2 mm- 2.4 grams – 1%
Total weight: 176.5 grams

Largest fragment: 46 mm (long bone)
Cranial thickness: 3-3.5 mm
Overall degree of burning: Low

There are 11 cranial fragments weighing 19.6 grams which are tan in color with white edges. There is one fragment of the maxilla with a one root tooth socket, likely an incisor. These fragments are both unsplit and split between the cranial tables and separated between the sutures. There are three tan scapula fragments weighing 5.7 grams; one fragment is a fused portion of the glenoid fossa. There are five tan vertebral fragments weighing 5.2 grams. These fragments consist of three vertebral body fragments and two articular facets. One of the vertebral body fragments has a complete fusion line and an attached pedicle. There are 78 long bone fragments weighing 132.0 grams. These bones exhibit longitudinal, transverse, and spiral fractures and are tan in color with black and blue in places. One of the fragments is a portion of the right ulna shaft with coronoid process. There are 60 unidentified fragments which are tan, black, blue, grey, and white in color and weigh 14.0 grams.

Grave 70

Sex: unidentifiable
Age: infant (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 18.2 grams – 52%
5 mm – 16.0 grams – 45%
2 mm – 1.1 grams – 3%
Total weight: 35.3 grams

Largest fragment: 31 mm (cranium)
Cranial thickness: 1.5 mm
Overall degree of burning: Low/Moderate

There are 35.3 grams of bone fragments from this grave. There are 33 cranial fragments which are very thin, weigh 16.5 grams, and are bluish-grey in color. The left and right petrous bones are present. There are 20 long bone fragments weighing 8.6 grams. These fragments are very small and have very thin curling along the edges. One fragment is the unfused head of either the femur or humerus (24 mm top to bottom). All long bone fragments are tan except for slight calcining on a few pieces. There are 41 unidentified fragments weighing 10.2 grams. There is one fragment that could not be determined whether human or animal; it is either a long bone shaft of an animal or a shaft of a juvenile metatarsal or metacarpal. Although the individual is juvenile, the shaft is extremely small. There are also 14.8 grams of soil.

Grave 72

Sex: unidentifiable
Age: 13+ years (distal humerus); 15+ years (distal ulna)
Pathologies: none present

Size weights:
10 mm – 31.1 grams – 91%
5 mm – 3.0 grams – 8.7%
2 mm – 0.1 grams – 0.3%
Total weight: 34.2 grams

Largest fragment: 37 mm (long bone)
Cranial thickness: 3 mm
Overall degree of burning: Low

There are four cranial fragments which are tan in color and weigh 1.7 grams. There are 25 tan long bone fragments weighing 30.7 grams; one of the fragments is the fused distal end of an ulna and there is the distal end of the humerus with a fragment of the capitulum present. These fragments are dark brown in color. There are nine unidentifiable fragments weighing 1.8 grams. There are 4.5 grams of soil.

Grave 73

Sex: unidentifiable
Age: 14+ years (distal metatarsal); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 110.1 grams – 72%
5 mm – 39.1 grams – 26%
2 mm – 2.9 grams – 2%
Total weight: 152.1 grams

Largest fragment: 41 mm (long bone)
Cranial thickness: 4-5 mm
Overall degree of burning: Low

There are 29 cranial fragments weighing 29.8 grams. They are tan, grey, and white in color and both split and unsplit between the cranial tables. A fragment of the petrous bone is present. There are six tan vertebral fragments which are tan in color and weigh 6.6 grams. These fragments include the dens of the axis, an articular facet, a portion of a cervical vertebra with pedicle, a centrum of a cervical vertebra, a separate pedicle, and portion of atlas. There is one foot bone present weighing 0.5 grams; it is the fused distal end of a metatarsal and is tan in color. There are four tan scapula fragments weighing 1.9 grams. Two of the fragments are part of the lateral border and two are part of the scapular body. There are 67 tan and light brown long bone fragments with white on the edges weighing 74.9 grams that have longitudinal, transverse, and spiral fracturing. There is one fragment of the distal end of the tibia and one fragment which has green staining from contact with bronze or copper. There are 80 unidentifiable fragments weighing 37.0 grams. There is also one animal bone fragment weighing 1.4 grams.

Grave 75

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 57.7 grams – 87%
5 mm – 8.3 grams – 12%
2 mm – 0.6 grams – 1%
Total weight: 66.6 grams

Largest fragment: 54 mm (long bone)
Cranial thickness: 5-6 mm (split between tables)
Overall degree of burning: Low

There are 14 tan, white, and grey cranial bones which weigh 13.2 grams; two of these fragments are tan portions of the frontal crest. There is one large blue-grey rib fragment weighing 0.8 grams. There are 44 tan and grey long bone fragments weighing 47.7 grams which exhibit longitudinal, spiral, and transverse fracturing with slight warping and no surficial cracking. There are also 39 tan and dark grey unidentified fragments weighing 4.9 grams.

Grave 76

Sex: unidentifiable
Age: infant (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 2.7 grams – 28%
5 mm – 4.1 grams – 43%
2 mm – 2.8 grams – 29%
Total weight: 9.6 grams

Largest fragment: 23 mm (petrous bone)

Cranial thickness: ~ 1 mm

There are 33 cranial bones weighing 3.1 grams. Both the left and right petrous bones are present weighing 2.6 grams and being white and grey in color. There are five long bone fragments weighing 0.7 grams which exhibit longitudinal and transverse fracturing. There are two white rib fragments weighing 0.3 grams. There are also 72 unidentifiable fragments weighing 2.9 grams. There are 2.6 grams of soil. Aside from the two petrous bones, the other bones are extremely small and very thin.

Grave 78

Sex: unidentified
Age: adult (size of acetabulum)
Pathologies: none present

Size weights:
10 mm – 53.2 grams – 97%
5 mm – 1.3 grams – 2%
2 mm – 0.3 grams – 1%
Total weight: 54.8 grams

Largest fragment: 53 mm (pelvis)
Cranial thickness: 5 mm (both cranial tables); 2.5 mm (outer table and diploë)
Overall degree of burning: Low

There are 54.8 grams of cremated bone from this grave. There are two tan, grey, and blue cranial fragments weighing 1.9 grams, 10 tan and light grey long bone fragments weighing 14.2 grams, and one rib fragment weighing 0.4 grams. The long bone fragments have slight shallow surficial cracking, transverse, longitudinal, and spiral fracturing and slight warping and curving. There are two tan fragments of the pelvis, one being a section of the acetabulum, weighing 12.2 grams and nine light brown vertebral fragments weighing 19.1 grams. There are 21 fragments weighing 7.0 grams that could not be identified to a specific skeletal element and 9.6 grams of soil.

Grave 79

Sex: unidentifiable

Age: adult (bone morphology)
Pathologies: none present

Size weights:
10 mm – 119.9 grams – 92%
5 mm – 9.8 grams – 7.5%
2 mm – 0.7 grams – 0.5%
Total weight: 130.4 grams

Largest fragment: 67 mm (long bone)
Cranial thickness: 4 mm
Overall degree of burning: Low

There are four cranial fragments weighing 8.4 grams which are tan in color with grey edges. There are two tan rib fragments weighing 2.0 grams. There are six pelvic fragments weighing 22.4 grams; one of the fragments is a portion of the acetabulum. There is also a fragment with the auricular surface but it is heavily eroded so no age or determination of sex could be made (cannot tell if there was or wasn't preauricular sulcus.) There are 32 tan long bone fragments weighing 83.2 grams; one of the fragments is the neck of a femur. There is one vertebral fragment which is tan in color and weighs 1.2 grams. There is one fragment of the sacrum with an articular facet which is tan in color and weighs 1.1 grams. Two tan scapula fragments weighing 1.7 grams. There are 61 unidentifiable fragments weighing 10.4 grams. There are 3.1 grams of soil.

Grave 80

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 18.1 grams – 88.5%
5 mm – 2.4 grams – 11%
2 mm – 0.2 grams – 0.5%
Total weight: 20.0 grams

Largest fragment: 52 mm (long bone)

Cranial thickness: 2 mm (without inner table)
Overall degree of burning: Low

There are 20.0 grams of bone fragments present from this grave. There are two cranial fragment weighing 1.3 grams which are tan and grey in color. There are nine long bone fragments weighing 12.1 grams with longitudinal, transverse, and spiral fracturing. There is one tan vertebral fragment (a portion of the centrum) which weighs 1.0 grams and four unidentified fragments weighing 6.3 grams. There are six charcoal pieces weighing 5.1 grams and 5.3 grams of soil.

Grave 81-75d

Sex: male (no preauricular sulcus)
Age: 20+ years (fused vertebral ring); 21-30 years (smooth auricular surface)
Pathologies: none present

Size weights:
10 mm – 93.8 grams – 69%
5 mm – 41.4 grams – 30%
2 mm – 1.1 grams – 1%
Total weight: 136.3 grams

Largest fragment: 44 mm (long bone)
Cranial thickness: 4-5 mm
Overall degree of burning: Low

There are 49 cranial fragments weighing 40.1 grams. One of these fragments is a portion of the maxilla with a single root socket but the socket is filled with dirt and was not removed to prevent breakage, thus an accurate determination of which tooth could not be made. There is also a tan and grey fragment of the right mandible with the mylohyoid line. These fragments are all tan and light grey in color and are both split and unsplit between the cranial tables. The cranial thickness is approximately 4.5 mm. There 58 long bone fragments which are tan in color and have longitudinal, transverse, and spiral fracturing and edge curling. These fragments weigh 67.8 grams. There are five tan pelvic fragments weighing 8.3 grams. One fragment is a portion of the ilium with a smooth auricular surface and no preauricular sulcus. The auricular surface provides an age range of approximately 21-30 and a lack of preauricular sulcus is indicative of a male individual. There are two tan vertebral fragments weighing 0.5 grams; one of the fragments is a fused portion of the vertebral body. There is one tan scapula fragment weighing 0.6 grams and is a portion of the body. There is one white rib fragment weighing 0.1 grams. There are 81 unidentifiable fragments weighing 18.9 grams and 51.4 grams of soil and bone dust.

Grave 83

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 12.8 grams – 87%
5 mm – 1.5 grams – 10%
2 mm – 0.4 grams – 3%
Total weight: 14.7 grams

Largest fragment: 47 mm (long bone)
Cranial thickness: 2-2.5 mm
Overall degree of burning: Low

There are four tan cranial fragments weighing 3.9 grams with two petrous bone fragments. There are six tan and white long bone fragments weighing 7.1 grams with longitudinal and transverse fracturing and edge curling. There is one brown scapula fragment weighing 0.9 grams; it is a portion of the scapula body. There are 16 fragments weighing 2.8 grams which could not be assigned to a specific skeletal element; there was a portion of a long bone shaft which broke into four pieces. It is unknown if this fragment is human or animal.

Grave 84

Sex: unidentifiable
Age: 13+ years (proximal ulna); 14+ years (distal metacarpal/tarsal); 16+ years (proximal humerus)
Pathologies: cranial pitting (porotic hyperostosis)

Size weights:
10 mm – 140.6 grams – 57%
5 mm – 100.8 grams – 40%
2 mm – 7.2 grams – 3%
Total weight: 248.6 grams

Largest fragment: 51 mm (long bone)
Cranial thickness: 3-4.5 mm (with and without both cranial tables)
Overall degree of burning: Low

There are 55 cranial fragments weighing 42.7 grams. These fragments are mainly split along the diploë between the cranial tables and many fragments have a cranial thickness of 4.5 mm. There is one fragment with slight cranial pitting which is indicative of porotic hyperostosis. There are 141 tan long bone fragments weighing 140.0 grams. Some of these fragments include the fused coronoid process of the ulna, the fused head of the humerus, and the shaft of the ulna, radius, or fibula. Several of the fragments exhibit green staining typical of contact with a bronze artifact. There are 22 rib fragments weighing 10.6 grams which are tan in color and very thin. There is one fragment with the tubercle present. There are three vertebral fragments weighing 1.6 grams which are tan in color and have articular facets. There are ten scapula fragments weighing 5.9 grams which are tan and light grey in color. There is one tan pelvis fragment weighing 1.5 grams. There are 12 hand/foot fragments weighing 7.7 grams. Some of these fragments include six shaft fragments, a navicular fragment, the proximal end of a metacarpal, the fused distal end of either a metacarpal or metatarsal, the proximal end of the 4^{th} metacarpal, and a fragment which is either a portion of the pisiform or the distal end of a metacarpal or metatarsal. These are all tan in color. There is one animal bone (0.5 grams) which is a portion of the maxilla; however the specific animal could not be identified. There are 143 unidentified fragments weighing 38.1 grams which are tan and greyish-blue in color.

Grave 85

Sex: unidentifiable
Age: 13+ years (proximal ulna, distal humerus)
Pathologies: none present

Size weights:
10 mm – 136.3 grams – 95%
5 mm – 6.2 grams – 4%
2 mm – 0.9 grams – 1%
Total weight: 143.4 grams
Largest fragment: 61 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low

There are ten dark brown cranial fragments weighing 22.8 grams. These fragments are not split between the cranial tables and the left and right petrous bones are present. There are 38 dark brown long bone fragments weighing 100.8 grams; there is the proximal end of the ulna (photo) and the distal end of the humerus. These fragments exhibit longitudinal, spiral, and transverse fracturing. There is one brown rib fragment weighing 1.8 grams. There is one dark brown vertebral fragment weighing 2.9 grams, one brown scapula fragment weighing 2.4 grams, and one brown navicular weighing 1.8 grams. There is one animal bone weighing 1.0 grams; it is a fragment of the occipital of a pig. There are also 34 unidentifiable bone fragments that weigh 9.9 grams. There are 22.1 grams of soil.

Grave 86

Sex: unidentified
Age: 13+ years (distal humerus); 14+ years (distal metacarpal); 15+ years (distal radius); 17+ years (glenoid fossa); 20+ years (fused vertebral body)
Pathologies: none present

Size weights:
10 mm – 167.5 grams – 73%
5 mm – 55.7 grams – 24%
2 mm – 5.7 grams – 3%
Total weight: 228.9 grams

Largest fragment: 60 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low

There are 26 tan cranial fragments weighing 28.5 grams. There are the right and left petrous bones and the left mandibular condyle. There are 13 vertebral fragments weighing 13.1 grams which are tan in color. There are four fused cervical centrums, pedicles from three cervical vertebrae and one lumbar vertebra, one body fragment that could not be identified to a specific vertebra, two fragments with articular facets, and two additional vertebral fragments. There are four tan rib fragments weighing 1.4 grams which are warped and curled. There is one tan pelvis fragment; this fragment weighs 5.1 grams and is a portion of the ischium with the acetabular fossa. There are 89 tan and light grey long bone fragments weighing 137.9 grams. These bones include the distal end of the left humerus with the coronoid and olecranon fossas and the fused distal end of a radius. Several of these fragments exhibit green staining. There are eight tan and light grey scapula fragments weighing 4.8 grams. There is fragment of a fused glenoid fossa. There is a tan and grey fragment of the patella weighing 1.2 grams. There are two hand and foot bones; these fragments weigh 2.3 grams. These consist of the fused distal end of a metacarpal and the distal end and shaft of a 1st metatarsal. There are 137 light brown and grey fragments which could not be assigned to a specific skeletal element and which weigh 34.6 grams; there is one shaft fragment which is likely to be animal. Several of these fragments have green staining from bronze fragments. There are also 57.1 grams of soil.

Grave 87

Sex: unidentified
Age: adult (cranial thickness)
Pathologies: cranial pitting with lamellar bone formation (evidence of healing)

Size weights:
10 mm – 31.5 grams – 55%
5 mm – 23.2 grams – 40%
2 mm – 2.8 grams – 5%
Total weight: 57.5 grams

Largest fragment: 42 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Low

There are 16 tan cranial fragments which weigh 17.7 grams. One fragment has a foramen and may be a portion of a petrous bone. There is also an occipital fragment with a portion of the foramen magnum. There is slight cranial pitting with lamellar bone formation indicating healing on several fragments. There are 41 tan long bone fragments weighing 31.9 grams; these bones exhibit longitudinal, spiral, and transverse fracturing with minimal shallow surficial cracking. There are also 55 tan unidentified fragments weighing 7.9 grams. There are 60.8 grams of soil and bone dust and three urn fragments weighing 3.7 grams.

Grave 91

Sex: unidentifiable
Age: adult (cranial thickness, size of metacarpals)
Pathologies: none present

Size weights:
10 mm – 190.9 grams – 73%
5 mm – 58.9 grams – 23%
2 mm – 10.1 grams – 4%
Total weight: 259.9 grams

Largest fragment: 56 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Low

There are 59 cranial fragments weighing 51.6 grams. There is a portion of the occipital with external occipital protuberance. These fragments are grey and black in color. There are 155 long bone fragments which weigh 143.5 grams and are light grey in color. These fragments have u-shaped, longitudinal, spiral, and transverse fracturing. There are three tan and grey vertebral fragments weighing 0.7 grams. Two fragments have articular facets of cervical vertebrae and the other is a portion of the spinous process. There is one grey patella fragment weighing 0.7 grams. There are seven rib fragments weighing 1.0 grams which are tan in color. There are eight tan and grey scapula fragments which weigh 4.2 grams. There are the left and right distal ends of the 1st metacarpals which weighs 0.9 and 1.1 grams and are tan and grey in color. There is a portion of the navicular which weighs 0.5 grams. There are also 352 fragments which could not be assigned to a specific skeletal category and weigh 53.5 grams. There also 58.8 grams of bone dust and soil. There were four tan animal bones; (rib) weighing 0.3 grams, 1.6 jaw bone, (2) uni, 0.3 grams.

Grave 94

Sex: male (external occipital protuberance)
Age: 15+ years (fused distal humerus); 16+ years (fused iliac crest); 17+ years (fused glenoid fossa); 20+ years (fused vertebral ring); adult (cranial thickness)
Pathologies: cranial pitting (porotic hyperostosis)

Size weights:
10 mm – 374.3 grams – 80%
5 mm – 87.5 grams – 19%
2 mm – 5.2 grams – 1%
Total weight: 467.0 grams

Largest fragment: 58 mm (long bone)
Cranial thickness: 6-8 mm
Overall degree of burning: Low/Moderate

There are 46 cranial fragments weighing 87.4 grams. These fragments are dark brown with cranial thickness of 6-8 mm. The right petrous is present in addition to the external occipital protuberance which is very large and robust, typically of a male individual. There is one grey and white permanent tooth root present weighing 0.3 grams which is the 2nd permanent maxillary incisor. The age could not be ascertained from the tooth root due to the tip of the root being broken off, but from the morphology an age of 10+ years could be established. There are four tan pelvic fragments present weighing 12.2 grams, one fragment being a portion of the fused iliac crest. There is one fragment of the sternum present. This fragment of the corpus sterni is tan in color and weighs 1.5 grams. There are 17 rib fragments weighing 10.9 grams which are tan, black, and blue in color. One fragment has a large facet on the vertebral end. There are 13 light brown scapula fragments which weigh 15.1 grams. There are two fragments of the glenoid fossa and a fragment of the lateral border. There are four vertebral fragments weighing 11.1 grams. One fragment is a portion of the fused 5th lumbar vertebra and there is an articular facet from a lumbar vertebra. There are 162 long bone fragments weighing 260.8 grams. These fragments are brown and grey in color and have longitudinal, transverse, and spiral fracturing. The distal end of the humerus is present in addition to the head of a humerus. There is one fragment of a calcaneus present being tan in color and weighing 2.1 grams. There are 118 unidentified fragments weighing 65.6 grams which are brown and grey in color.

Grave 96

Sex: unidentifiable
Age: 14+ years (distal metacarpal/tarsal)
Pathologies: none present

Size weights:
10 mm – 75.2 grams – 70.0%
5 mm – 31.3 grams – 29.9%
2 mm – 0.2 grams – 0.1%
Total weight: 106.7 grams

Largest fragment: 45 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low

There are 106.7 grams of bone fragments from this grave. There are 23 cranial fragments weighing 15.3 grams and 55 dark brown long bone fragments weighing 75.5 grams. These fragments have longitudinal, spiral, and transverse fracturing with slight surficial cracking/exfoliation. There is the grey and white anterior portion of a patella weighing 2.7 grams (side indeterminate) and the dark brown distal end of either a metacarpal or metatarsal which weighs 0.6 grams. There are 40 dark brown and grey fragments weighing 12.6 grams which could not be identified to a specific skeletal element. There is also 13.6 grams of soil and one urn fragment weighing 1.2 grams.

Grave 96(2)

Sex: unidentifiable
Adult: unidentifiable
Pathologies: none present

Size weights:
10 mm – 0 grams – 0.0%
5 mm – 1.8 grams – 72.0%
2 mm – 0.7 grams – 28.0%
Total weight: 2.5 grams

Largest fragment: 14 mm (long bone)
Cranial thickness: 2 mm (without inner table)
Overall degree of burning: Low

There are two cranial fragments weighing 0.4 grams, two long bone fragments weighing 0.6 grams with longitudinal, spiral, and transverse fracturing, and ten unidentified fragments weighing 1.5 grams. These bones are tan and dark grey in color. There are 1.2 grams of soil and 1.0 grams of charcoal.

Grave 97

Sex: unidentifiable
Age: 14+ years (proximal phalanx); 20+ years (fused vertebral ring)
Pathologies: none present

Size weights:
10 mm – 19.5 grams – 46%
5 mm – 20.9 grams – 50%
2 mm – 1.5 grams – 4%
Total weight: 41.9 grams

Largest fragment: 43 mm (long bone)
Cranial thickness: 2 mm (without inner table)
Overall degree of burning: Low

There is 41.9 grams of bone fragments from this grave. There are nine tan cranial fragments weighing 5.8 grams, one of the fragments being a petrous bone, possibly from the right side. There are 25 tan long bone fragments weighing 25.2 grams with longitudinal and transverse fracturing and edge curling. There are two tan vertebral fragments weighing 1.6 grams, both being portions of centrums and one having a visible fused epiphyseal ring. There is the fused proximal end of a tan proximal hand phalanx weighing 0.2 grams. There are 41 unidentified fragments weighing 9.1 grams and 13.7 grams of soil.

Grave 97(2)

Sex: unidentified
Age: adult (size of lumbar vertebra)
Pathologies: none present

Size weights:
10 mm – 7.2 grams – 84%
5 mm – 0.8 grams – 9%
2 mm – 0.6 grams – 7%
Total weight: 8.6 grams

Largest fragment: 24 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

There are only 8.6 grams of bone fragments from this second assemblage from Grave 97. There are four long bone fragments weighing 6.6 grams which are dark tan with soil staining in places and exhibit longitudinal and transverse fracturing. There is one vertebral fragment weighing 0.7 grams and is brown in color; it is the articular facet of an adult lumbar vertebra. There are four unidentified fragments weighing 1.3 grams and two urn fragments weighing 1.5 grams.

Grave 98

Sex: unidentifiable
Age: 13+ years (fused distal humerus); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 33.3 grams – 84%
5 mm – 6.1 grams – 16%
2 mm – 0 grams – 0%
Total weight: 39.4 grams

Largest fragment: 49 mm (long bone)
Cranial thickness: 3.5-5 mm
Overall degree of burning: Low

There are 39.4 grams of bone fragments from this assemblage. There are dark brown four cranial fragments weighing 6.6 grams; two of these fragments are from a petrous bone. There are 18 dark brown long bone fragments weighing 25.9 grams, a dark brown fragment of a right patella weighing 1.9 grams, and 13 dark brown unidentified fragments weighing 5.0 grams. The long bone fragments exhibit longitudinal, transverse, and spiral fracturing with very thin surface cracks due to warping. One of the long bone fragments is a fragment of the fused distal end of the humerus. There are 10.2 grams of soil.

Grave 100

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 10.6 grams – 82%
5 mm – 2.3 grams – 17.7%
2 mm – 0.1 grams – 0.3%
Total weight: 13.0 grams

Largest fragment: 23 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

There are 13.0 grams of cremains from this grave. There are two tan cranial fragments weighing 1.8 grams, eight tan long bone fragments weighing 8.9 grams, and nine unidentifiable fragments weighing 2.3 grams. The long bone fragments are tan in color with longitudinal, transverse, and spiral fracturing. The cranial fragments may possibly be from either the sphenoid or the ethmoid. There is one urn fragment weighing 1.3 grams and 3.6 grams of soil and charcoal.

Grave 101

Sex: unidentifiable
Age: 13+ years (distal humerus); 15+ years (proximal humerus); 16+ years (distal femur, distal fibula)
Pathologies: anemia (varied growth in diploë across skull)

Size weights:
10 mm – 178.0 grams – 76%
5 mm – 51.7 grams – 22%
2 mm – 3.0 grams – 12%
Total weight: 232.7 grams

Largest fragment: 69 mm (long bone)
Cranial thickness: 3-5 mm
Overall degree of burning: Low

There are 25 cranial fragments which are dark grey and tan in color. These fragments weigh 48.8 grams and are split along the sutures and cranial tables; however there are several fragments were the cranial tables have not split. One of the fragments is a portion of the parietal bone and there is a fragment of mandible with a single root tooth socket. There are three tan vertebral fragments, all being centrum fragments, which weigh 1.5 grams and are tan in color. There are three rib fragments weighing 2.1 grams which are tan and light grey in color. There are four pelvis fragments weighing 10.4 grams. Of these fragments, there several fragments of the fused iliac crest. There are 91 long bone fragments. These fragments are grey and tan in color and weigh 129.0 grams. Some of these fragments include the fused head of the humerus, the fused distal end of the femur, the fused right distal end of the humerus, the fused distal end of the fibula, and the distal end of the humerus with the coronoid and olecranon fossas present. There are 110 unidentifed fragments weighing 38.8 grams which are tan in color with slightly grey edges. There are 72.7 grams of soil and bone dust. There is one distal epiphysis of a femur of a red deer; this fragment weighs 2.1 grams and is tan in color.

Grave 102

Sex: unidentifiable

Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 22.9 grams – 64%
5 mm – 12.7 grams – 35.5%
2 mm – 0.2 grams – 0.05%
Total weight: 35.8 grams

Largest fragment: 48 mm (long bone)
Cranial thickness: 3 mm (both tables present, slight warping); 1.5 mm (one table only)
Overall degree of burning: Low

There are eight dark brown cranial bones weighing 5.7 grams. There are 35 dark brown and black long bone fragments which weigh 27.3 grams and exhibit longitudinal and transverse fracturing. There are two dark brown rib fragments weighing 0.6 grams. There are nine unidentifiable fragments weighing 2.2 grams.

Grave 104

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 1.5 grams – 63%
5 mm – 0.8 grams – 33%
2 mm – 0.1 grams – 4%
Total weight: 2.4 grams

Largest fragment: 22 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

There are four tan long bone fragments weighing 2.2 grams with longitudinal and transverse fracturing and two tan unidentifiable fragments weighing 0.2 grams.

Grave 105

Sex: unidentifiable
Age: unidentifiable

Pathologies: none present

Size weights:
10 mm – 13.1 grams – 75%
5 mm – 4.3 grams – 24.5%
2 mm – 0.1 grams – 0.5%
Total weight: 17.5 grams

Largest fragment: 32 mm (long bone)
Cranial thickness: 3-3.5 mm
Overall degree of burning: Low

There are 17.5 grams of cremains present. There are four cranial fragments that are tan and white in color weighing 2.8 grams. There are 15 tan and dark brown long bone fragments weighing 10.7 grams which exhibit u-shaped, longitudinal, and transverse fracturing. There is one tan fragment of the calcaneus weighing 0.9 grams. There are 13 fragments that could not be identified weighing 3.1 grams, one urn fragment weighing 0.4 grams and two rocks weighing 2.3 grams.

Grave 106

Sex: unidentifiable
Age: 14+ years (proximal phalanx); 16+ years (distal femur); adult (navicular morphology, ischium size)
Pathologies: none present

Size weights:
10 mm – 126.2 grams – 85%
5 mm – 21.9 grams – 14%
2 mm – 1.2 grams – 1%
Total weight: 149.3 grams

Largest fragment: 73 mm (long bone)
Cranial thickness: 4 mm (with/without both cranial tables)
Overall degree of burning: Low

There are 29 tan and grey cranial fragments weighing 16.0 grams. There are two vertebral fragments weighing 0.5 grams. There is one tan scapula fragment weighing 0.9 grams. There are 47 tan long bone fragments weighing 103.0 grams. These fragments exhibit longitudinal, spiral, and transverse fracturing with edge curling and few surficial cracks. There is a fragment of the fused distal epiphysis of the femur. There are four hand/foot fragments weighing 6.6 grams. One of the fragments is the fused proximal phalanx (hand or foot unknown), a fragment of the right talus, and the right and left naviculars. There is one pelvis fragment weighing 4.3 grams which is a portion of the ischium with the acetabulum. There are 62 unidentified fragments weighing 18.0 grams. There are 32.3 grams of soil and bone dust.

Grave 107

Sex: unidentifiable
Age: 14+ years (fused metacarpal)
Pathologies: none present

Size weights:
10 mm – 130.3 grams – 66%
5 mm – 61.2 grams – 31%
2 mm – 5.4 grams – 3%
Total weight: 196.9 grams

Largest fragment: 46.5 mm (long bone)
Cranial thickness: 3.5-4 mm
Overall degree of burning: Low

There are 45 cranial fragments weighing 41.1 grams with an approximate cranial thickness of 3.5-4 mm. These fragments are tan in color and there is a fragment of the frontal bone with the frontal crest. These fragments are split along the diploë and the sutures, with several fragments retaining both the inner and outer tables. The right mandibular condyle is also present. There are 102 long bone fragments weighing 96.6 grams which are tan in color and exhibit longitudinal, spiral, and transverse fracturing and shallow surficial fissuring. There are four tan pelvic fragments weighing 7.5 grams. There are two thin rib fragments which weigh 0.6 grams and are tan in color. There are four tan vertebral fragments weighing 5.5 grams. There is an articular facet from a thoracic vertebra and two vertebral bodies. There are seven tan scapula fragments weighing 4.3 grams, one fragment being of the lateral border. There is one distal end of a 2nd metacarpal and a portion of the navicular. These hand and foot fragments weigh 2.0 grams. There are 86 unidentified fragments which weigh 39.3 grams.

Grave 108

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 46.5 grams – 61%
5 mm – 18.9 grams – 25%
2 mm – 11.2 grams – 14%
Total weight: 76.6 grams

Largest fragment: 36 mm (cranium)
Cranial thickness: 4.5-5 mm
Overall degree of burning: Low

There are 76.6 grams of bone fragments from this assemblage. There are tan and grey 65 cranial fragments weighing 49.6 grams which are tan in color and split along the diploë into the inner and outer cranial tables. There are 23 tan long bone fragments weighing 17.2 grams with longitudinal, spiral, and transverse fracturing with slight curling. There are 35 unidentified fragments which weigh 9.8 grams and 35.9 grams of soil.

Grave 109

Sex: unidentifiable
Age: adult (cranial suture)
Pathologies: none present

Size weights:
10 mm – 16.0 grams – 55%
5 mm – 12.0 grams – 41%
2 mm – 1.1 grams – 4%
Total weight: 29.1 grams

Largest fragment: 34 mm (long bone)
Cranial thickness: 4-4.5 mm

Overall degree of burning: Low

There are 12 tan, grey, and white cranial fragments weighing 5.0 grams. There are 25 brown long bone fragments weighing 22.6 grams; these fragments have longitudinal, spiral, and transverse fracturing with slight cracking due to warping. One of the cranial fragments exhibits a suture which is typical of that of an adult. There are 20 brown, grey, and white unidentified fragments weighing 1.5 grams and 10.0 grams of soil.

Grave 111

Sex: unidentifiable
Age: 13+ years (fused distal humerus; fused radial heads)
Pathologies: none present

Size weights:
10 mm – 61.7 grams – 67%
5 mm – 26.4 grams – 29%
2 mm – 3.8 grams – 4%
Total weight: 91.9 grams

Largest fragment: 58 mm (long bone)
Cranial thickness: 4.5 mm
Overall degree of burning: Low

There are 24 tan, grey, and white cranial fragments weighing 14.7 grams. There are 44 long bone fragments weighing 50.4 grams which include the left and right fused radial heads and a fragment of the distal epiphysis of the humerus. There are four rib fragments weighing 1.6 grams which are tan in color with white and blue edges. There are three pelvis fragments weighing 6.6 grams and the left and right patella which weigh 5.9 grams and are brown and grey in color. There are 107 brown, white, and grey unidentified fragments weighing 12.7 grams, the majority of which is spongy bone. There are 31.1 grams of soil and one urn fragment weighing 1.3 grams.

Grave 112

Sex: unidentifiable

Age: 15+ years (complete sockets of maxillary incisors, canine, 1st maxillary premolar); young adult (open cranial suture)
Pathologies: none present

Size weights:
10 mm – 105.7 grams – 68%
5 mm – 44.3 grams – 28%
2 mm – 6.1 grams – 4%
Total weight: 156.1 grams

Largest fragment: 56 mm (long bone)
Cranial thickness: 4 mm
Overall degree of burning: Low

There are 58 cranial fragments weighing 25.4 grams. There is a portion of an adult maxilla with four tooth sockets from the left side: the 1st and 2nd incisors, canine, and 1st premolar. There are open sutures on two fragments, indicating a younger individual. There are six scapula fragments weighing 2.4 grams which are tan and light grey in color. There are three tan, brown, and light grey rib fragments weighing 0.8 grams. There is one light grey pelvis fragment weighing 1.3 grams. There are 85 tan and light grey long bone fragments weighing 99.6 grams. These fragments exhibit longitudinal, spiral, and transverse fracturing, edge curling, and slight warping. The trochlea of the distal end of the humerus is present. There are also several fragments which have green staining due to contact with bronze or iron. There is one foot fragment weighing 2.5 grams; it is the trochlea of a talus. There are 150+ tan, blue, and light grey unidentified fragments weighing 24.1 grams. There are also 33.8 grams of soil. There is one fragment of bronze weighing 0.7 grams and 1 urn fragment weighing 7.5 grams.

Grave 113

Sex: unidentifiable
Age: 13+ years (proximal ulna); 14+ years (distal metatarsal); 16+ years (proximal humerus)
Pathologies: none present

Size weights:
10 mm – 74.3 grams – 50%
5 mm – 60.9 grams – 41%

2 mm – 13.3 grams – 9%
Total weight: 148.5 grams

Largest fragment: 39 mm (humerus head)
Cranial thickness: 2.5 mm (without inner table)
Overall degree of burning: Low/Moderate

There are 49 cranial fragments weighing 27.0 grams. These bones are tan, grey, and white in color, with some fragments have been exposed to higher temperatures than others. They are both split and unsplit between the cranial tables. There is one grey scapula fragment weighing 0.6 grams. There are 84 long bone fragments; these bones weigh 73.8 grams, are tan, black, and greyish-blue in places, and exhibit longitudinal, spiral, transverse fracturing and warping. There is a portion of an ulna shaft, the fused head of a humerus, and the proximal end of an ulna with a fused olecranon process. There are four tan and grey rib fragments weighing 2.0 grams. There is a tan fragment of the fused distal end of a metatarsal weighing 1.1 grams and the proximal end of a metatarsal, likely the 3rd, weighing 0.7 grams. There are also 240+ fragments that could not be assigned to a specific skeletal category; these fragments are tan, black, and grey in color and weigh 43.3 grams.

Grave 114 (b)

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 12.9 grams – 89%
5 mm – 0.6 grams – 4%
2 mm – 1.0 grams – 7%
Total weight: 14.5 grams

Largest fragment: 44 mm (long bone)
Cranial thickness: 2.5 mm (without inner table)

There are four cranial bones weighing 1.7 grams, one being a petrous bone. There are ten tan and brown long bone fragments weighing 11.7 grams; these bones exhibit transverse, spiral, and longitudinal fracturing. There is one white scapular body fragment weighing 0.6 grams and 12 unidentified fragments weighing 0.5 grams.

Grave 114 (b)(2)

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 28.0 grams – 85%
5 mm – 5.0 grams – 15%
2 mm – 0 grams – 0%
Total weight: 33.0 grams

Largest fragment: 35 mm (long bone)
Cranial thickness: 2.5-3 mm
Overall degree of burning: Low

These bones are from a separate envelope marked 114 (b) and will be analyzed separately from the other bones marked 114 (b). There are three tan cranial very thin bones weighing 2.4 grams. There are 18 brown long bone fragments weighing 21.2 grams with longitudinal and transverse fracturing with edge curling. There is also a fragment of the capitulum from one of the humerii. There are two brown scapular body fragments weighing 1.9 grams. There is one tan pelvis fragment weighing 3.0 grams and seven unidentifiable fragments weighing 4.5 grams. There are 12.4 grams of rocks and soil.

Grave 116

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 12.3 grams – 78%

5 mm – 3.2 grams – 21%
2 mm – 0.2 grams – 1%
Total weight: 15.7 grams

Largest fragment: 28 mm (long bone)
Cranial thickness: 2.5-3 mm
Overall degree of burning: Low

There are 12 tan cranial fragments weighing 4.3 grams; two of the fragments are from a petrous bone. There are 18 tan long bone fragments weighing 7.3 grams with longitudinal, transverse, and diagonal fracturing with slight edge curling. There are 28 tan unidentifiable fragments weighing 3.9 grams. There is one unidentifiable animal bone fragment which weighs 0.2 grams. There are 4.7 grams of soil and three urn fragments weighing 0.4 grams.

Grave 117

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 2.4 grams – 47%
5 mm – 2.7 grams – 53%
2 mm – 0 grams – 0%
Total weight: 5.1 grams

Largest fragment: 30 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

There are 5.1 grams present from this grave; all of the fragments present are tan long bone fragments (11 in total) with longitudinal, transverse, and diagonal fracturing. No further information could be obtained from these remains.

Grave 117(2)

Sex: unidentifiable
Age: infant (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 0.7 grams – 13%
5 mm – 3.3 grams – 60%
2 mm – 1.5 grams – 27%
Total weight: 5.5 grams

Largest fragment: 15 mm (long bone)
Cranial thickness: 2 mm
Overall degree of burning: Low

There are 5.5 grams of bone fragments present. There are 25 tan cranial fragments weighing 3.4 grams, six tan long bone fragments weighing 0.7 grams, and 27 unidentified fragments weighing 1.4 grams. Bones from this grave are very thin and very small, judging by the paper thin texture of the cranial bones, this is most likely the remains of an infant or neonate.

Grave 120

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 11.8 grams – 86%
5 mm – 1.5 grams – 11%
2 mm – 0.4 grams – 3%
Total weight: 13.7 grams

Largest fragment: 24 mm (cranium/long bone)
Cranial thickness: 4 mm
Overall degree of burning: Low

There are 13.7 grams present from this assemblage. There are eight cranial fragments weighing 8.7 grams, three tan long bone fragments weighing 4.2 grams, and three tan fragments with grey edges that weigh 0.8 grams and could not be identified. The cranial fragments are not split between the tables and the long bone fragments display longitudinal and transverse fracturing with slight external cracking and fissuring.

Grave 122

Sex: unidentifiable
Age: 13+ years (proximal radius, ulna); 14+ years (distal metatarsal); 16+ years (fused iliac crest); 50+ years (obliterated suture); adult (navicular size)
Pathologies: none present

Size weights:
10 mm – 235.3 grams – 75%
5 mm – 71.2 grams – 23%
2 mm – 6.1 grams – 2%
Total weight: 312.6 grams

Largest fragment: 57 mm (long bone)
Cranial thickness: 4-5 mm (at frontal crest)
Overall degree of burning: Low

There are 35 cranial fragments weighing 49.0 grams. These fragments are light brown and tan in color and have been barely burned. Many of the fragments have meningeal grooves present. The fragment of the frontal bone with the frontal crest is present and has a cranial thickness of 3-5 mm. There is one cranial fragment with an obliterated suture, indicating an individual over 50 years of age. There is one tan sacral fragment present weighing 2.0 grams; this fragment is a portion of the sacral promontory. There are three pelvic fragments present weighing 2.7 grams which are tan in color. One of the fragments is a portion of the iliac crest and another is a portion of the acetabulum. There are six scapula fragments which weigh 1.6 grams and are tan with white and grey coloring in places. There are 146 long bone fragments weighing 194.1 grams. These fragments are tan in color with longitudinal, transverse, and spiral fracture patterns. There is the fused head of a radius, the fused olecranon process of the right ulna, the fused head of the left ulna, and a portion of the femoral epiphysis. There are three tan foot fragments; the left navicular, the distal end of the 1st metatarsal, and the fused distal end of another left metatarsal. These fragments weigh 4.0 grams. There are 214 tan unidentifiable fragments weighing 55.9 grams and 76.7 grams of soil and bone dust. There are two animal bone fragments weighing 3.3 grams; these include an atlas fragment from a goat and a fragment of the maxilla from either a goat or sheep. These bones are tan and grey in color.

Grave 134

Sex: unidentifiable
Age: 14+ years (distal metatarsals); 15+ years (distal radius, proximal femur); 16+ years (proximal humerus); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 232.5 grams – 70%
5 mm – 63.1 grams – 19%
2 mm – 34.8 grams – 11%
Total weight: 330.4 grams

Largest fragment: 95 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Low

There are 39 cranial fragments weighing 36.4 grams. There is a fragment of the occipital bone and a fragment of the zygomatic bone. There are 155 long bone fragments weighing 216.5 grams with longitudinal, transverse, and spiral fracturing. There is the head of a humerus, the proximal end of a femur, the fused distal end of a right radius with the ulnar notch and the fused distal radial articular surface. These fragments exhibit slight edge curling and are tan and bluish-grey in color. There is one tan patella fragment, being the lateral articular facet and weighing 3.3 grams. The anterior side of this bone fragment has burned away to expose the underlying trabecular bone. There is one tan vertebral fragment with an articular facet weighing 0.2 grams. There are two rib fragments weighing 0.4 grams which are tan and greyish blue in color. There are eight tan scapula fragments weighing 5.0 grams. There are five foot fragments weighing 5.8 grams. These fragments include three fused distal ends of metatarsals, the trochlea of the right talus, and the edge of the trochlea of the left talus. There are also 700+ tan, dark grey, and blue unidentified fragments which weigh 62.8 grams. Also, there are 310.7 grams of soil and bone dust.

Grave 135

Sex: unidentifiable
Age: 14+ years (distal metatarsal, phalanges); 15 years (complete permanent mandibular 2nd premolar); 16+ years (iliac crest); Under 21 years (incomplete mandibular 3rd molar); 16-20 years
Pathologies: none present

Size weights:
10 mm – 172.7 grams – 30%
5 mm – 268.9 grams – 47%
2 mm – 132.1 grams – 23%
Total weight: 573.7 grams

Largest fragment: 52 mm (cranium with frontal crest)
Cranial thickness: 3-3.5 mm
Overall degree of burning: Low

There are 153 cranial bones weighing 105.7 grams. There is a fragment of the frontal bone with the frontal crest, fragment of the mandible with tooth socket, three petrous fragments and a portion of the orbital bone. These fragments are split and unsplit between the cranial tables and the cranial thickness is between 3-4 mm. There are seven fragments from tooth roots weighing 0.9 grams; these fragments include a permanent 2nd mandibular premolar, the incomplete root of a 3rd mandibular molar, and two incomplete broken roots of molars. These fragments are blue and grey in color. There are four tan pelvis fragments weighing 3.0 grams; three of the four fragments are portions of the iliac crest. There are three tan vertebral fragments weighing 2.5 grams. One of these fragments is the body and pedicle of a cervical vertebra; there is also a fragment of an articular facet and another pedicle. There are 24 rib fragments weighing 8.1 grams. These fragments are light grey and tan in color. There are two fragments with the tubercle and one fragment of the vertebral end. There are 21 fragments of the scapula; these fragments weigh 9.8 grams and are light grey and tan in color. One of the fragments is a portion of the lateral border. There are 317 tan and light grey long bone fragments weighing 237.8 grams which exhibit longitudinal, spiral, and transverse fracturing and horizontal surface cracking. There are five hand/foot bones: an adult scaphoid, the fused distal head of a metatarsal, two distal phalanges of the foot, and a shaft fragment. These fragments weigh 1.6 grams and are tan and grey in color. There are 2130+ unidentifiable fragments which weigh 202.4 grams and are tan, grey, black, blue, and white. There are 145.2 grams of soil, rocks, and bone dust. There is one animal bone which is a tan rib fragment that weighs 1.9 grams.

Grave 137

Sex: unidentifiable
Age: 13+ years (distal humerus); 15+ years (distal radius); 16+ years (proximal humerus) 20+ years (fused vertebral body)
Pathologies: none present

Size weights:
10 mm – 99.3 grams – 64%
5 mm – 49.5 grams – 32%
2 mm – 6.6 grams – 4%
Total weight: 155.4 grams

Largest fragment: 53 mm (long bone)
Cranial thickness: 4 mm
Overall degree of burning: Low

The envelope in which these bones were stored stated P 134, however there was a tag on the inside suggesting that these bones may be from P 137. There are 24 cranial fragments weighing 19.9 grams which are tan, grey-blue, and white in color. They are split and unsplit along on the diploë and separated along the sutures. There are two vertebral fragments weighing 1.5 grams. These bones are tan in color and consist of a fragment with an articular facet and a fragment of the centrum with a complete fusion line. There are 16 tan rib fragments weighing 7.0 grams. There are 79 long bone fragment weighing 87.0 grams which are tan in color. These bones include the fused distal end of the right humerus with the coronoid fossa and the trochlea present, a fragment of the humerus head, the fused distal end of the left humerus, and the fused distal end of a radius. These fragments exhibit edge curling, longitudinal, transverse, and spiral fracturing with very slight surficial cracking. There is one tan sternal fragment weighing 1.3 grams. It is the superior end of the manubrium with the jugular or suprasternal notch. There are three tan scapula fragments weighing 1.7 grams. One of these fragments is a portion of the acromion process. There are four tan pelvis fragments weighing 3.4 grams. There is one foot bone weighing 1.7 grams; it is the neck and portion of the trochlea of the right talus. There are 203 unidentifiable fragments weighing 31.4 grams and 97.5 grams of soil and bone dust. There are three tan animal bone fragments weighing 0.5 grams; one of the fragments has been identified to be a mandible fragment from a stone marten.

Grave 137(2)

Sex: unidentifiable
Adult: 14+ years (proximal phalanx); adult (navicular morphology)
Pathologies: none present

Size weights:
10 mm – 114.6 grams – 70%
5 mm – 42.1 grams – 26%
2 mm – 7.2 grams – 4%
Total weight: 163.9 grams

Largest fragment: 50 mm (long bone)
Cranial thickness: 3.5 mm
Overall degree of burning: Low/Moderate

There are 38 cranial fragments with cranial thickness of 3.5 mm. These fragments are dark grey and tan in color, weigh 19.8 grams, and are both split and unsplit between the cranial tables. There are 69 tan long bone fragments weighing 93.1 grams. Looking at the proximal end of the tibia from the proximal view, a fragment is present with both the intercondylar tubercles. There are three tan and grey vertebral fragments weighing 0.8 grams; one of these fragments is a pedicle, one is an articular facet, and one is a fragment of a centrum. There are three hand/foot bones present; these weigh 1.9 grams and are tan and grey in color. There is the fused proximal end of a proximal phalanx (hand or foot unknown), a portion of a phalanx, and a navicular. There are 200+ unidentifiable fragments weighing 48.3 grams which are tan, grey, and blue in color with white on the edges.

Grave 138

Sex: unidentifiable
Age: infant (size, cranial thickness)
Pathologies: none present

Size weights:
10 mm – 1.1 grams – 7%
5 mm – 3.2 grams – 21%
2 mm – 11.2 grams – 72%
Total weight: 15.5 grams

Largest fragment: 20 mm (cranium)
Cranial thickness: 1-1.5 mm
Overall degree of burning: Low

This cremation is extremely fragmented and most likely represents the bones of an infant or neonate due to the very thin nature of the bones. The pieces cannot be picked up due to immediate breakage. There are ten cranial bones weighing 1.5 grams and 13.9 grams of unidentifiable bone fragments. There is one long bone shaft fragment weighing 0.1 grams; it is extremely fragile and could not be picked up without the possibility of further damage. Fragments are tan in color with very light burning.

Grave 139

Sex: unidentifiable
Age: adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 46.7 grams – 75%
5 mm – 13.6 grams – 22%
2 mm – 1.9 grams – 3%
Total weight: 62.2 grams

Largest fragment: 64 mm (long bone)
Cranial thickness: 5 mm
Overall degree of burning: Low/High

There are 12 cranial bones weighing 7.7 grams; five of these bones are calcined and the other seven are tan in color and barely burned. This may indicate differential burning across the skull. These fragments are mainly unsplit between diploë, with one bone having split along the suture at the fragment's edge. One of the fragments is the very top of a mandibular condyle. There are 34 tan long bone fragments weighing 48.4 grams with longitudinal, spiral, and transverse fracturing. There is one tan scapula body fragment weighing 0.4 grams. There are 37 tan and white unidentifiable fragments weighing 5.7 grams. There are 7.8 grams of soil and six urn fragments weighing 12.3 grams.

Grave 141

Sex: unidentifiable
Age: 14+ years (fused metacarpal), under 30? (unfused epiphyses)
Pathologies: none present

Size weights:
10 mm – 46.1 grams – 58%
5 mm – 29.1 grams – 37%
2 mm – 4.3 grams – 5%
Total weight: 79.5 grams

Largest fragment: 34 mm (cranium)
Cranial thickness: 2.5-3 mm
Overall degree of burning: Low

There are 18 tan cranial fragments weighing 9.9 grams which are tan in color and mainly split along the sutures. There are 58 tan long bone fragments weighing 36.4 grams. There are three brown rib fragments weighing 0.8 grams. One of the rib fragments has a costal facet present. There is one brown vertebral fragment weighing 0.4 grams which is a thin fragment of a pedicle from a cervical vertebra. There are 3.1 grams of hand and foot bones. There is one navicular, the fused distal end of a metacarpal (0.8 grams), and a portion of the talus (medial view, right?). There are 169 unidentified fragments weighing 28.9 grams. There are ten urn fragments weighing 15.3 grams and 60.8 grams of soil and bone dust. There are several bones, especially long bone fragments, with unfused epiphyses; however, there is not any specific feature which would indicate what bone or area of the skeleton the unfused areas are from which would provide a more concrete window for age. As the maximum age for an unfused epiphysis is 30 years (medial end of the clavicle), this has been established as the maximum age for the individual.

Grave 144

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 30.0 grams – 52%
5 mm – 26.6 grams – 46%
2 mm – 0.9 grams – 2%
Total weight: 57.5 grams

Largest fragment: 38 mm (long bone)
Cranial thickness: 4 mm
Overall degree of burning: Low

There are seven dark brown cranial fragments weighing 4.5 grams. There are 57 dark brown long bone fragments weighing 47.5 grams with longitudinal and transverse fracturing with slight edge curling. There are 18 dark brown unidentified fragments weighing 5.5 grams.

Grave 147

Sex: unidentifiable
Age: 13+ years (proximal ulna); adult (cranial thickness, talus morphology)
Pathologies: none present

Size weights:
10 mm – 100.0 grams – 75%
5 mm – 25.8 grams – 19%
2 mm – 7.8 grams – 6%
Total weight: 133.6 grams

Largest fragment: 56 mm (cranium)

Cranial thickness: 6 mm
Overall degree of burning: Low

There are 35 tan cranial fragments with an average cranial thickness of 6 mm. These fragments weigh 57.8 grams and are split along the diploë and the sutures. On many of the fragments meningeal grooves are visible. There are seven tan vertebral fragments weighing 12.8 grams. One of the fragments is a portion of the axis; the dens is missing from this fragment. There is a fragment of the vertebral body from a lumbar vertebra, a centrum from a cervical vertebra with pedicle, another centrum, and three vertebral body fragments. There are 44 long bone fragments with longitudinal, transverse, and spiral fracturing with little to no surficial cracking. These fragments weigh 28.8 grams and are tan, black, and dark blue in color. There is a shaft fragment from either the radius or ulna and a corocoid process of a fused ulna. There are three scapula fragments weighing 2.9 grams that are light brown in color. There are three tan pelvis fragments weighing 4.3 grams. There is a fragment of a talus with the plantar side being complete and having the sulcus tali present. It is tan in color and weighs 1.7 grams. There are 210+ unidentified fragments weighing 25.3 grams and 84.5 grams of soil.

Grave 148

Sex: unidentifiable
Age: 13+ years (proximal radius); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 98.8 grams – 84%
5 mm – 16.8 grams – 14%
2 mm – 1.7 grams – 2%
Total weight: 117.3 grams

Largest fragment: 79 mm (long bone)
Cranial thickness: 6 mm
Overall degree of burning: Low

There are six cranial bones weighing 12.6 grams; one of the fragments is the right petrous bone. There are 39 tan and dark brown long bone fragments weighing 76.2

grams. There is the fused head of the radius (21 and still missing part of one side). There are two brown vertebral fragments weighing 1.8 grams; one of the fragments is the body with pedicle and the other fragment is a portion of a lumbar vertebra. There is a brown distal end of the 1st metacarpal (0.8 grams) and one brown and blue navicular weighing 1.4 grams. There are 90 brown and grey unidentifiable fragments weighing 24.5 grams and 11.4 grams of soil. There are four urn fragments weighing 16.3 grams.

Grave 153

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 86.3 grams – 78%
5 mm – 23.6 grams – 21%
2 mm – 1.3 grams – 1%
Total weight: 111.2 grams

Largest fragment: 54 mm (long bone)
Cranial thickness: 4 mm
Overall degree of burning: Low

There are nine tan and grey cranial fragments weighing 9.3 grams; one of the fragments is a portion of the right temporal bone with the zygomatic arch, postglenoid process, articular eminence, and mandibular fossa. There is also a large mandibular condyle. There are 57 long bone fragments weighing 94.7 grams. These bones exhibit longitudinal and transverse fracturing with cortical twisting. There is one brown rib fragment weighing 0.7 grams with the costal notch present. There are 17 tan unidentified fragments weighing 6.5 grams. There are 23.3 grams of soil and 13 urn fragments weighing 19.7 grams.

Grave 156

Sex: unidentifiable
Age: 14+ years (proximal phalanx); 15+ years (distal radius); 17+ years (glenoid fossa)
Pathologies: none present

Size weights:

10 mm – 76.8 grams – 52%
5 mm – 63.3 grams – 43%
2 mm – 7.1 grams – 5%
Total weight: 147.2 grams

Largest fragment: 46 mm (long bone)
Cranial thickness: 3 mm (without inner table)
Overall degree of burning: Low

There are 147.2 grams of cremains from this grave. There are 22 tan cranial fragments weighing 12.6 grams that have split along the sutures and between the diplöe into separate inner and outer tables. There are 103 long bone fragments weighing 97.9 grams with longitudinal and transverse fracturing. One fragment is the fused distal end of the radius with the ulnar notch present. Many of these fragments are just thin cortical pieces that have curled off from the rest of the diaphyses. There is a portion of the scapula weighing 1.4 grams; it is a part of a fused glenoid fossa. There is one tan rib fragment weighing 0.7 grams, seven tan vertebral fragments weighing 4.2 grams and the fused proximal end of a medial hand phalanx which weighs 0.4 grams and a tan fragment of the 1st metatarsal weighing 0.9 grams. There are 141 unidentified fragments weighing 29.1 grams and 98.0 grams of soil.

Grave 164

Sex: unidentifiable
Age: 15+ years (distal ulna)
Pathologies: none present

Size weights:
10 mm – 130.5 grams – 70%
5 mm – 51.4 grams – 28%
2 mm – 4.2 grams – 2%
Total weight: 186.1 grams

Largest fragment: 51 mm (long bone)
Cranial thickness: 3 mm
Overall degree of burning: Low

There are 27 tan cranial fragments weighing 30.0 grams. There is a portion of the supraorbital margin and a small portion of the browridge; however, despite being sexually dimorphic features, there is not enough of the bone present to make an attempt at a determination of sex. These fragments are unsplit between the cranial tables. There are 84 tan long bone fragments weighing 138.5 grams. These bones include the fused distal end of the ulna and the shaft of the left ulna with the radial notch. There is one scapula fragment weighing 0.3 grams which is a portion of the lateral border. There are 65 unidentifiable fragments weighing 17.3 grams which are tan in color. There are also 25.3 grams of soil and bone dust.

Grave 171

Sex: unidentifiable
Age: 11+ years (complete incisor sockets); adult (bone morphology)
Pathologies: none present

Size weights:
10 mm – 239.0 grams – 81%
5 mm – 53.5 grams – 18%
2 mm – 3.0 grams – 1%
Total weight: 295.5 grams

Largest fragment: 77 mm (long bone)
Cranial thickness: 3-4 mm
Overall degree of burning: Low/Moderate

There are 13 cranial bones which weigh 13.9 grams, are tan and dark brown in color, and are both split and unsplit between the diploë. There is a fragment of the maxilla with the palate with three tooth sockets from the labial section of the maxillary bone. These tooth sockets appear to be from three out of the four maxillary incisors. The left petrous bone is present. The cranial thickness is approximately 3-4 mm. There are 136 tan, dark brown and grey long bone fragments with longitudinal, transverse, and spiral fracturing which weigh 267.2 grams. There are two pelvic fragments weighing 3.2 grams. They are black in color with one fragment being a portion of the acetabulum. There are two scapula fragments weighing 2.4 grams. They are tan in color with one fragment being a portion of the scapular body and the other being a portion of the lateral border. There are 48 unidentifiable fragments weighing 8.8 grams. They are tan and dark brown with grey edges. There is also 54.9 grams of rocks, soil, and bone dust. A long bone fragment weighing 2.8 grams was taken for a sample.

Grave 173

Sex: unidentifiable
Age: 14+ years (proximal phalanx); 15+ years (distal ulna)
Pathologies: none present

Size weights:
10 mm – 91.4 grams – 81%
5 mm – 14.9 grams – 13%
2 mm – 6.2 grams – 6%
Total weight: 112.5 grams

Largest fragment: 42 mm (long bone)
Cranial thickness: 3.5-4 mm
Overall degree of burning: Low

There are 25 tan and grey cranial fragments weighing 36.5 grams. There is one dark grey rib fragment weighing 0.8 grams. There are 47 long bone fragments weighing 64.3 grams. These bones exhibit longitudinal, spiral, and transverse fracturing. There is the head of either the femur or humerus which exhibits green staining from contact with copper or bronze. There is the fused distal end of the right ulna with the styloid process. There is one grey fused proximal end of a proximal hand phalanx weighing 0.6 grams. There are 135 unidentified fragments weighing 10.3 grams.

Grave 175

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 40.6 grams – 71%
5 mm – 14.3 grams – 25%
2 mm – 2.0 grams – 4%
Total weight: 56.9 grams

Largest fragment: 39 mm (long bone)

Cranial thickness: 4-4.5 mm
Overall degree of burning: Low

There are ten brown cranial bones weighing 13.7 grams; one of the bones is the right mandibular condyle. There are 25 brown long bone fragments weighing 35.7 grams which are tan in color with blue and grey edges. These bones exhibit longitudinal and transverse fracturing with slight surficial cracking along warping planes. There is one dark brown patella fragment weighing 1.4 grams and a fragment of the scapula which is light brown in color and weighs 1.3 grams. There are 36 white unidentifiable fragments weighing 4.8 grams.

Grave 177

Sex: unidentifiable
Age: adult? (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 34.4 grams – 69%
5 mm – 14.2 grams – 29%
2 mm – 1.2 grams – 2%
Total weight: 49.8 grams

Largest fragment: 62 mm (long bone)
Cranial thickness: 3-5 mm
Overall degree of burning: Low

There are five brown and grey cranial fragments weighing 4.4 grams, 23 brown long bone fragments weighing 40.1 grams with longitudinal and transverse fracturing and edge curling, and 32 brown and grey unidentified fragments weighing 5.3 grams.

Grave 178

Sex: unidentifiable
Age: unidentifiable
Pathologies: none present

Size weights:
10 mm – 50.2 grams – 88%

5 mm – 5.1 grams – 9%
2 mm – 1.7 grams – 3%
Total weight: 57.0 grams

Largest fragment: 73 mm (long bone)
Cranial thickness: N/A
Overall degree of burning: Low

There are 57.0 grams of bone fragments from this grave. There are 25 tan long bone fragments weighing 54.9 grams with warped edges and longitudinal, curved, and transverse fracturing. The remaining 2.1 grams are comprised of 14 tan, grey, and white unidentified fragments.

Grave 226

Sex: unidentifiable
Age: 13+ years (distal humerus, proximal radius); 14+ years (distal metacarpal, proximal phalanx, medial phalanx, 1st distal phalanx of the foot); 15+ years (proximal femur, distal ulna); 16+ years (proximal humerus); adult (cranial thickness)
Pathologies: none present

Size weights:
10 mm – 389.5 grams – 72%
5 mm – 133.9 grams – 25%
2 mm – 20.1 grams – 3%
Total weight: 543.5 grams

Largest fragment: 60 mm (long bone)
Cranial thickness: 6 mm
Overall degree of burning: Moderate

There are 65 cranial fragments weighing 71.9 grams with a cranial thickness of 6 mm. These fragments are both split and unsplit between the cranial tables and are dark blue and black in color with white edges. The left mandibular condyle is present. There are 230 long bone fragments with longitudinal, transverse, and spiral fracturing with slight warping. These fragments weigh 322.9 grams and are beige and pale blue in color. There is a portion of the femoral head with the fovea capitis, the fused distal end of the ulna, a fragment of the humeral head, fragment of the fused distal end of the left humerus with the capitulum present, and a radial head. Of the foot and hand bones, there are 19 fragments in total weighing 19.3 grams. There is a blue medial phalanx (hand or foot unknown), the 1st distal phalanx of the foot, the right talus with trochlea, an additional talus fragment, the fused distal end of the 3rd or 4th metacarpal, the fused proximal end of a proximal phalanx (hand or foot unknown), a fragment of the hamate, and two proximal ends of metatarsals. There are 18 rib fragments weighing 8.3 grams which are light brown and blue in color. One fragment retains a sharp caudal edge. There are 19 scapula fragments present weighing 14.8 grams which are beige, dark blue, and light grey in color. There are eight vertebral fragments present weighing 9.3 grams. There are the dens of the axis, 3 fragments with articular facets, 3 centrum fragments, and 1 fragment with the spinous process. There are six pelvic fragments weighing 17.6 grams which are tan in color. There are also 500+ unidentified fragments weighing 79.4 grams, several of which have green staining typical of contact with bronze artifacts. There are also 96.8 grams of bone dust.