1.01 Izvirni znanstveni članek

Cremation Studies: Developmental Research within Slovenian Osteoarchaeology.

Proučevanje kremacij: razvoj raziskav v slovenski osteoarheologiji

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Abstract: From the year 1952 on, a series of Late Bronze Age and Early Iron Age cemeteries were excavated in the region of Štajerska (Slovenian Styria). One hundred and sixty-nine individuals were selected for analysis from three Late Bronze Age Urnfield period sites (Ruše II, Gračič near Brinjeva gora and Pobrežje). 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 and any animal bones present were acknowledged. This study aims to supplement existing research on the Late Bronze Age period and Early Iron Age in Slovenia and will provide new information regarding burial techniques.

Keywords: Cremation, osteology, Slovenia, Urnfield Culture, Early Iron Age

Izvleček: Po letu 1952 so na Slovenskem Štajerskem potekala številna izkopavanja grobišč iz časa kulture žarnih grobišč in starejše železne dobe, med dostopnim kostnim gradivom pa so bili za pričujočo analizo izbrani ostanki 169 oseb iz treh pripadajočih žarnogrobiščnemu obdobju (Ruše II, Gračič pod Brinjevo goro in Pobrežje). Kot dodatek k običajni osteološki analizi so bile raziskane tudi spremembe na kostnih ostankih, ki so povezane s kremacijo. Določeni so bili temperatura ognja, vzorci fragmentacije, ohranjenost različnih elementov ter splošna fragmentacija in ohranjenost. Raziskava vsake osebe je vključevala tudi analizo starosti in spola, ob tem pa je bila zabeležena tudi vsaka posamezna živalska kost. Namen raziskave je bil dopolniti dosedanje raziskave iz obdobij kulture žarnih grobišč in starejše železne dobe ter ponuditi nove podatke o načinu pokopa.

Ključne besede: kremiranje, osteologija, Slovenija, kultura žarnih grobišč, starejša železna doba

Introduction

Within the field of archaeology, osteological research has provided valuable information regarding population demographics and mortuary practices for ancient cultures around the world. From human remains, an osteologist can determine the age, sex, and stature of an individual and provide information on pathologies, trauma, occupation, health, diet, burial traditions, and mortuary rituals. Although it becomes a more difficult task, the same information can be obtained from cremated remains, provided the assemblage of burned remains contains specific age and sex related features and well preserved bones.

Research on cremated remains first began at the beginning of the 20th century. Initially, reports were scarce; burned remains discovered in the field or in a funerary urn were discarded due to the belief that little to no information could be obtained from such small fragments of bone. The few assemblages which were kept were placed into boxes and stored in museums or academic institutions until funding could be acquired for such specific analysis. During the 1990s, researchers began to generate replicative cremation studies in order to study the effects of burning on human bone. These studies focus on shrinkage rates, temperature of firing, fracture patterns, cremation weights, fragment survival, changes due to environmental factors, and the morphological changes to bone structure at the microscopic level (Baby 1954; Binford 1963; Bohnert et al. 1998; Holden 1995; Holland 1989; Lisowski 1968; Mays 1998; McCutcheon 1992; McKinley 2000; McKinley 1989; McKinley, Bond 2001; Noy 2000; Shipman et al. 1984; Spence 1967; Walker, Miller, Richman 2008). A brief discussion of these projects is shown in *Table 1.*

Also during this time, the number of published cremation reports began to increase due to the development of a standardized procedure for processing assemblages of burned bones (McKinley 1989, 65; McKinley 1993, 283; McKinley 1994b, 5; McKinley, Roberts 1999, 7-8). The recent integration of cremation studies into site reports and publications has allowed for osteological data to accompany and complement other areas of archaeology and create a holistic overview of the culture or time period under study.

The contribution of osteological research becomes even more significant to understanding mortuary rituals when cremation is the only utilized burial practice. If cremation studies are overlooked or not incorporated, valuable information regarding population demographics and mortuary practices for that specific culture or region may be lost.

This article details a recent study undertaken by the author as a part of a PhD project on cremated remains from the region of Štajerska (Slovenian Styria). They were recovered from a series of Late Bronze Age Urnfield period and Early Iron Age sites, where cremation has been utilized as the primary burial method.

Cremation Study	Description
Fracture Patterns	Burned remains will display varying fracture patterns depending on whether the bones were cremated with the flesh attached, recently defleshed, or dry.
Shrinkage Rates	Due to dehydration of water and the organic component of bone, each fragment will have an unknown degree of shrinkage which must be taken into account if measurements are being taken.
Temperature of Firing	Bones will display different colors depending on the temperature and length of time in which they were fired.
Cremation Weights	The weight of the cremated bone collected for burial in comparison with the expected weight for a fully cremated bone will show what percentage of the body was collected for burial.
Fragment Survival	Certain skeletal features will survive burning better than others due to specific bone composition.
Environmental Cremation vs. Modern Cremation	Factors such as weather, nightfall, temperature fluctuations, amount of available fuel, and ash buildup will affect the resulting state of the cremation.
Bone Structure Morphology	The crystalline structure of bone changes as firing temperatures increase.

Table 1. Replicative cremation studies.
Tabela 1. Raziskave kremacij s ponovitvami njihovih okoliščin.

This research represents the first major cremation study on osseous materials from multiple Late Bronze Age and Early Iron Age sites in eastern Slovenia.

Study Sample

A series of Late Bronze Age and Early Iron Age sites were excavated from the year 1952 onwards and a collection of cremated remains has been discovered at each location. These cremations were curated at the Pokrajinski muzej maribor (Maribor Regional Museum) and available for study. In order to have an adequately sized population, the author acquired cremations from three major Late Bronze Age sites; these remains would allow for an osteological analysis of an adequately sized population with a comparative study across several Late Bronze Age sites.

The cemeteries of Ruše (II), Gračič at Brinjeva gora, and Pobrežje are characterized by cremation burials in flat grave fields; graves from these sites tended to be shallow pits dug into the soil with a large stone or stone slab placed over the top; the cremated human remains had been placed in an urn or scattered at the base of the pit with bones placed in specific piles (Teržan 1990, 56). Ruše 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 in Ruše and during this excavation a second cemetery was discovered (Ruše II), containing 35 cremation graves (Mason 1996, 42; Pahič, S. 1957, 68). In 1993, subsequent excavations at Ruše II cemetery as part of a salvage operation directed by M. Strmčnik Gulič from the Maribor Regional Office of the Institute for the Protection of Cultural Heritage of Slovenia recovered additional remains (Črešnar 2006, 97). Twenty-six individuals were analyzed from the Ruše II cemetery.

The settlement at Brinjeva gora and the associated cemetery at Gračič were first excavated by S. Pahič in 1953 and 1955 (Oman 1983, 153; Pahič, V. 1989). It is located 680 meters above sea level on an elevated hilltop in the Drava River Basin. Analyses of excavated pottery have led to the conclusion that Brinjeva gora was densely occupied during the Ha 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, S. 1962-1963, 357; Pahič, S. 1981, 71-143; Oman 1983, 153). Sixty-five cremations from Gračič at Brinjeva gora were analyzed as a part of this study.

The site of Pobrežje is located near the modern city of Maribor within the Drava River valley. It was excavated in 1936, 1939, 1952-1964 and 1973 and consisted of 178 cremation graves (Pahič, S. 1972, 7-9; 1991). Pobrežje is considered to have been comprised of 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 destroyed during fieldwork. 77 cremations were available from Pobrežje.

Methodology

For this specific research project, the author employed the standardized methods as discussed in the standard guidelines for the treatment of cremated remains (Brickley, McKinley 2004; McKinley, Roberts 1993). 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. The remains were still in their original packaging when they were delivered to the author at the University of Ljubljana. 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.

At the start of the laboratory analysis, all materials were emptied out of the paper envelopes 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. Materials from each grave were passed through a series of sieves with mesh sizes of 10 mm, 5 mm, and 2 mm 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. If dry brushing did not remove the attached soil, bones were washed and set out for several days to ensure that the remains dried thoroughly. After bones were cleaned, 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, fragments were separated into categories based on skeletal element and any animal bones were extracted for a separate analysis. Each group of identifiable bones separated by skeletal element was then weighed to 0.01 grams; after this stage, 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. Once this analysis was complete, bones were sealed into labeled bags for future storage.

Ageing of the individuals was based primarily on epiphyseal fusion, suture closure, bone morphology, and dental development. In most cases, only a broad age range could be determined for each individual. Methods of ageing based on dental wear or attrition were not utilized due to the absence of enamel from the teeth. The determinations of sex were based on bone robusticity and various sexually dimorphic characteristics; however due to the limited number of characteristics from which sex could be ascertained, only a few of the methods of sex determination were used. Stature determinations were not achievable, as there were no complete bones from which measurements could be taken which could be then incorporated into stature calculations.

It was assumed that the bones from each grave represented the remains of one individual. Although no duplicate bones were recovered from one grave, this does not necessarily mean that bones from one individual could have been placed into multiple graves.

Results:
Age of Individuals

It was determined that out of the 169 cremations analyzed, an approximate age could be established for 123 individuals or 73%. Many individuals could only be categorized as “adult” due to the absence of other skeletal features which would assist in narrowing

down or clarifying the age range. From Ruše II, one individual was classified as an infant based on the thickness of the cranial fragments and one individual established as being less than 23 years of age based on a fragment of an unfused iliac crest. The remaining 13 individuals from which a determination of age could be established were considered "adult." There was one individual within the 11-15 year range, one individual between the 12-15 year range, and one individual over 50+ years from Brinjeva gora. The remaining individuals were considered to be "adult." From Pobrežje, there were three individuals that were categorized as being "neonate/infant", two individuals who were aged between 21 and 30 years of age, and one individual which was categorized as "old adult" based on an obliterated cranial suture. The remaining individuals are considered to be "adult."

Based on the established age of the individuals from each site, it does not appear that there is a bias towards one specific age group being buried at the cemeteries. Although the majority of the individuals have been classified as "adult", due to the absence of certain age-related characteristics it is impossible to narrow the age ranges any further.

It is important, when considering the age of the individuals from this study, to note the work of J. Angel and his research on the Mecklenberg Collection, which is curated at the Peabody Museum at Harvard University. His study involved the osteological analysis of skeletal remains from several Early Iron Age sites from Slovenia which make up the Mecklenburg collection. Based on the analysis of 32 individuals, Angel determined that 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). Although there is no way to provide an average age of death for males or females from the individuals in this specific study, it is worthy of note to keep in mind the average age at death established by Angel for people from the Early Iron Age in Slovenia.

Sex

Out of the three sites mainly investigated, there were only eight individuals from which an estimation of sex could be assigned. There is a section of the right zygomatic arch and a section of the orbital bone with a rounded superior margin and protruding browridge for grave 10, Ruše II,; these sexually dimorphic features tend to be characteristic of male individuals. One of the orbital fragments from grave 21, Ruše II, 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 grave 32 which measures 22 mm in diameter. This measurement falls within the range which is typical for female individuals.

Only one individual from Gračič had any sexually diagnostic features from which an estimation of sex could be obtained. Grave 53, Gračič, 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.

Grave 27, Pobrežje, has been determined to be female due to a fragment of the ilium with the preauricular sulcus. The presence of this sexually dimorphic feature, along with its deep and narrow morphology, is a characteristic of a female individual. Pobrežje grave 36 contains fragment of the frontal bone with a large browridge and a rounded supraorbital margin, which are typically male characteristics. Grave 81 Pobrežje has one fragment of the ilium with the preauricular sulcus absent. Due to the fact that males tend to not have a preauricular sulcus, this individual has been determined to be male. The individual in grave 94, Pobrežje has been determined to be a male individual based on the presence of an occipital fragment exhibiting a very large and robust external occipital protuberance.

As with determining the age of an individual, it is important to keep in mind that unless certain sexually dimorphic features are present for analysis, the osteologist will not be able to make an accurate determination of sex. At the site of Spong Hill, McKinley was only able to accurately sex 38.4% of the population under study (1994, 68). For the three Slovenian sites, only 4.7% were able to be sexed accurately. Again, this

result is not surprising when taking into consideration the small amounts of bone which were collected for burial. Without sexually dimorphic features being present in the cremation, the osteologist can only rely on robusticity of the remains, and even this methodology is not always reliable due to normal variation within every population.

Out of the 169 cremations analyzed, only nine individuals exhibited any sign of infected lesion or pathological trauma. No fractures were identified on any of the bones; however this is not surprising due to the small amounts of bone collected for burial and the various fracture patterns which occur across the bones during the cremation process. The two pathologies discovered were cases of osteoarthritis and porotic hyperostosis, as evidenced by osteoarthritic lipping, porotic hyperostosis and vault thickening.

Only two individuals show evidence for osteoarthritis. Grave 20 from Ruše II contains a vertebral centrum with slight proliferative exophytic bone growth and from Grave 26 at Pobrežje 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 osteoarthritis 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 which could be determined based on the bone fragments present, so it is not possible to attribute the presence of arthritis necessarily to old age and overall spinal degeneration.

The remaining seven individuals with pathological lesions are those with signs of porotic hyperostosis as evidenced by cranial pitting. Porotic hyperostosis is hematopoietic disorder causing lesions of the cranial vault due to overactivity of the bone marrow, resulting in thickening of the diploë and thinning of the outer cranial table (Larsen 1997, 30; Lewis 2007, 111; Roberts, Manchester 2005, 229; Stuart-Macadam 1985, 394; Stuart-Macadam 1992, 39; White, Folkens 2005, 320). When the outer bone layers of the cranial vault become porous due to thinning, it begins to exhibit a spongy appearance as opposed to the smooth appearance of healthy bone (Cohen 1989, 107; Stuart-Macadam 1987b, 522; Stuart-Macadam 1998, 47). It has been widely accepted that this disease is indicative of severe anemia, caused primarily by iron deficiency (Brown 2000, 470; Larsen 1997, 30; Roberts, Cox 2003, 234; Stuart-Macadam 1985, 391; Stuart-Macadam 1987a, 519; Stuart-Macadam 1987b, 521; Stuart-Macadam 1989, 191; Stuart-Macadam 1992, 40).

The low number of pathological lesions discovered on the Slovenian remains is not unanticipated. Due to the small nature of each cremation, it is unlikely that the specific bone areas which 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, creating further difficulties for accurate identification by the osteologist.

Cremation features

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. This information suggests immediate placement of the body on the pyre with subsequent burning. 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.

The remains from Ruše and Pobrežje were left on the pyre for short periods of time at low temperatures as evidenced by the light colouring of the bones. Bones from Gračič were generally left on the pyre for a longer period of time at slightly higher temperatures, as shown by the blackened coloration and higher degree of burning. 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.

After a short period of burning, the bones were allowed to cool before collection of fragments for placement in the urns. Only an extremely small percentage of the individual was collected for burial. It would seem that although small in quantity, the

amount of bone fragments placed into the grave was an adequate representation of the deceased. Although large numbers of skull and long bone fragments were recovered 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.

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.

Conclusion

Overall, the majority of the cremation graves were diminutive in size, which prevented the collection of certain types of information. The determination of age and sex was only obtainable if specific age and sex related features were present. Without any distinguishable features, characteristics such as robusticity and size were utilized to establish information about the individual. While this is not the most reliable method of ageing and sexing, it is the method an osteologist must utilize when the particular bone features are not present. There was little evidence of pathologies or trauma; again this is not surprising due to the small nature of the assemblages. If an individual had bones which displayed evidence of trauma or pathologies, those fragments may not have been included in the collection for burial, and therefore any information would not be obtained.

Although it may seem that little data was obtained from this study, it is quite the opposite. While it is true that the majority of the graves contained very little quantities of bone, this is an important burial feature which reveals information regarding the specific collection of bones and ritual procedures. Determinations of age were obtained for more than half of the cremation graves and an establishment of sex was ascertained for several individuals. Bones were present which exhibited pathological lesions, which provided information regarding diet and occupation for the population under study. Temperatures of firing were obtained and the fracture patterns present provided information regarding the state of the bones during the cremation. Animal bones were also found within the assemblages; specific animals have been identified which has shed light on burial practices and mortuary rituals during the Urnfield period of the Late Bronze Age.

The incorporation of osteological and cremation studies is an important component of archaeology which provides auxiliary information and supplements previously completed projects. Within Slovenia, the addition of osteological and cremation analyses is expanding existing knowledge on the Late Bronze Age and the Early Iron Age and allowing for new archaeological investigations to develop. The comprehensive synopsis of an ancient society's cultural traditions can be achieved only when all facets of archaeological are included and evaluated collectively; this permits various areas of research to enhance one another and produces a thorough and detailed understanding of the society under study.

Proučevanje kremacij: razvoj raziskav v slovenski osteoarheologiji (Povzetek)

Osteološke raziskave so nedvomno postale dragocen vir informacij in integralen člen širše arheološke discipline. Njihov doprinos so informacije, ki zadevajo demografsko sestavo prebivalstva, njihove pogrebne običaje in končno pripomorejo k boljšemu razumevanju raziskovane skupnosti.

Rezultati, ki jih lahko pridobimo iz skeletnih in kremiranih kostnih ostankov, so enaki, a je pri določanju slednjih naloga precej zahtevnejša. Ostanki morajo biti kar se da dobro ohranjeni, za natančnejše določanje pa je obvezna prisotnost spolno in starostno značilnih elementov.

Žal so bili v preteklosti žgani človeški ostanki pogosto prezrti, saj je veljalo, da v sebi nosijo izredno malo informacij.

Ob standardnih raziskavah pa v zadnjem času posebno pozornost raziskovalcev vedno pogosteje pritegnejo analize vpliva ognja na kosti, kar je že privedlo do standardizacije postopkov ugotavljanja, kako je kremacija potekala. To pa zagotavlja napredek tudi v delu stroke, ki se s takšno vrsto ostankov srečuje.

Pred kratkim zaključena avtoričina raziskava, ki je upoštevala standardne metode za osteološke analize, je pod drobnogledom imela kremirane človeške ostanke 169 posameznikov z žarnogrobiščnih nekropol Ruše II, Gračič pod Brinjevo goro in Pobrežje. Med analiziranimi kostnimi vzorci so bilieprisotne tudi spolno in starostno specifične oblike, ki so omogočale natančnejšo določitev preminulih. Prav tako so bili prepoznani nekateri bolezenski znaki, ne pa tudi zlomi oz. druge hujše telesne poškodbe. Zanimiva je tudi primerjava med načinom sežiganja, ki temelji na prepoznavanju s tem povezanih znakov na vseh analiziranih kremacijah.

S temi izsledki, ki dovoljujejo tudi nove pristope k nekdaj že zaključenim raziskavam, je predstavljen doprinos antropoloških raziskav k poznavanju različnih vidikov arheologije, ki kot vsak podoben dosežek le širi njen domet in veča njeno relevantnost.

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