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Osteological Analysis of Commingled and Fragmented Human Remains: Two Case Studies From 6th – 9th-century Saaremaa, Estonia

MA dissertation

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Table of Contents

Introduction

Commingled human remains are mixed deposits of disarticulated and often fragmented bones that come from multiple individuals and sometimes include the remains of animals and/or artefacts (Knüsel & Robb 2016, 657). These types of remains have often been interpreted as relating to a variety of funerary rites or other factors, including the disturbance of primary burials, taphonomic processes and even to inadequate documentation and excavation practices (Knüsel 2004, 85-86).

Even though commingled remains are a frequent find in both archaeological as well as anthropologic cases, they are often ignored or not properly analysed. This may be partly due to time constraints and because standard osteological protocols may not always be applicable (Lambacher et al. 2016, 1).

The aim of this master's thesis is to study fragmented and commingled human remains in order to test the applicability of standard methods used to determine the minimal number of individuals contributing to the assemblage as well as the age and sex of those individuals. Two case studies from two graves in Saaremaa Island, Estonia will be analysed: (1) **Viidumäe** grave found in 2014 and has been dated to 7th–9th century AD (Mägi et al. 2014, 94), and (2) **Lepna** grave found in 2001–2002, interpreted as a mortuary house, has been dated to the 5th–7th century AD (Mägi 2003, 45).

A bioarchaeological perspective will be applied. This means a thorough analysis of the fragmented and commingled remains from the burials will be conducted to obtain information about the population profile. The population profile reconstruction will focus on the following aspects: (1) the Minimum Number of Individuals (MNI); (2) age estimation; and (3) sex estimation. For these determinations, commonly used methods will be applied: the chart for the sequence of formation and eruption of teeth by Ubelaker (1989), the wear of the occlusal surfaces of the teeth Brothwell (1963) and the standard of identifying sex based on cranial morphology provided by Ascádi & Nemeskéri (1970). This thesis analyses whether and to what extent these methods can be applied in studying altered and commingled remains at Viidumäe and Lepna.

The main objectives are as follows:

1. To analyse the osteological material of Viidumäe and Lepna in order to find out the population profile of the burials.
2. To see how the standard osteological methods used comply with commingled and fragmented remains and describe the possible issues in applying those methods.
3. To create a written analysis of the osteological material of both Viidumäe and Lepna that can be used as the main or complimentary source for further research.
4. To show that even though the information gained from commingled and fragmented remains may be imperfect, it can still add valuable information to the interpretations.

The first chapter of this thesis will give a brief outline of the process of commingling and types of commingled remains that could be encountered during archaeological excavations, as well as the history of the study of commingled human remains. It is largely a referential chapter meant to introduce the terminology and research history of commingled remains. The third subchapter gives an overview of the archaeological contexts of Viidumäe and Lepna, as well as a review of previous research performed on the remains from both sites. The second chapter introduces the materials and methods used during this research along with the limitations. The third chapter presents the results of both case studies and their preliminary interpretations. Chapter four will open a broader discussion of the results from both case studies and discuss the applicability of standard methods on the chosen material.

The importance of this study lies in its newness in terms of using teeth as a complimentary element in deriving the minimum number of individuals from a commingled context and in the fact that the osteological analysis performed on the human remains from Viidumäe was only preliminary while the analysis on the remains from Lepna was never properly finished. The results gained from this study will hopefully add new information about the population profiles of both Viidumäe and Lepna as well as extend our understanding on the nature of commingled and fragmented human remains and the methods used to study them.

I would like to thank my supervisors – **Marge Konsa**, **Raili Allmäe** and **Marika Mägi** for their endless patience and advice. I would also like to thank **Aivar Kriiska** for sharing his humorous wisdom with me during long car rides, **Alessandra Morrone** for her contagious enthusiasm, **Raija Katarina Heikkilä** for supplying me with books and material I never knew I needed and **Mari Tõrv** for her kind optimism during the final leg of the thesis.

1. Historical Background and Literature Review

1.1 The process of commingling and types of commingled assemblages

Commingled human skeletal assemblages can be cause by three main processes: (1) taphonomic, (2) cultural (e.g., handling of the body after death), and (3) management of the remains during research (e.g., excavation, lab processes and storing) (Robb 2016, 690). The cultural causes of commingling can, however, be also divided into three processes: deposition, removal and *in situ* destruction (*ibid*., 684-685).

Commingled and fragmented osseous remains (either human or faunal or a mixture of both) have been often rendered indistinguishable due to a severe mixing of elements (Osterholtz et al. 2014, 8) as these types of remains have frequently been interpreted as relating to a variety of funerary rites including above-ground exposure, defleshing, dismemberment and secondary burials (Knüsel 2004, 85). While fragmentation is not always necessary to interpret a set of commingled remains as such, it typically does accompany the mixing of skeletal elements and in some cases, is severe enough that it interferes with the identification of elements and the development of a complete biological profile (Osterholtz et al. 2014, 8).

The most common commingled assemblage types include long-term usage of cemetery/grave, primary long-term usage commingled assemblages and secondary long-term usage commingled assemblages. The first type is a result of primary and/or secondary interments from a community. During long-term usage of a tomb, the extant remains will be inadvertently moved around and jostled when new burials are brought in. This in turn can result in commingling and fragmentation (Osterholtz et al. 2014, 2-3). The second type of commingling can happen when new burials are placed on top of older interments as the smaller skeletal elements may filter down to the bottom of the burial place during the period of decomposition, causing them to become commingled. The third type, however, represents a type of handling of the body where the deceased are processed in one location, but the remains are gathered together and disposed within a secondary structure. This means that the third type results from an intentional multistage process (*ibid*., :3).

Yet another type of commingled assemblages result from mass burials which are typically connected to warfare or an outbreak of a disease resulting in mass fatalities such as the plague. Being episodic in nature, mass graves indicate the death of multiple individuals at the same time. This, in turn, makes them different from long-term usage burials as they are characterized by minimal commingling, neglectful burial and little fragmentation (*ibid*:, 3).

In Estonia, commingled and fragmented human remains can be found in every era. The material, however, has not been studied much and has been published even less. Commingled human remains are known, for example, from Late Bronze-Age (Jõelähtme), Pre-Roman Iron Age (Kurevere), Roman Iron Age (Jäbara B), Middle Iron Age (Lehmja Loo III), Late Iron Age (Madi) but these finds are rather sporadic and underexploited (Lang 2007).

The commingled and loose bones without clear archaeological context, especially regarding Middle- and Early-and Late Modern Age, are handled by a standard where the bones are collected, studied for pathologies and either reburied or kept in a collection for teaching purposes.

For example, in 2002, commingled human remains were found in the Kivissaare Mesolithic settlement and burial site. The human bones seemed to be distributed in two concentrations while single scattered bones were found between them. It can be assumed that the remains belonged to at least nine different individuals, both non-adults and adults, and that at least some of the commingled remains could be interpreted as belonging to a reburial as well as the bottom of a destroyed or partly disturbed grave (Kriiska et al. 2003, 35-37).

1.2 The scientific study of fragmented and commingled human remains

The first major text focused specifically on forensic anthropology was *The Human Skeleton in Forensic Medicine* by **Wilton Krogman** published in 1962. While widely recognized, it presented very little discussion of the issues of commingling in the analysis of human remains. The more focused *Essentials of Forensic Anthropology* (1979) by **T. Dale Stewart** devoted only two pages out of 300 on the topic of commingling, even though publications on the matter, such as those focused on bone weight analysis (Baker and Newman 1957), ultraviolet fluorescence (Eyman 1965; McKern 1958), forensic neutron activation (Guinn 1970), statistical approaches to commingling issues (Sow and Folk 1965), and other considerations (Kerley 1972) were already available by the time. Stewart did, however, note that most remains studied by forensic anthropologists at that time were found as primary skeletons, indicating that commingling was likely not a major issue (Adams & Byrd 2014, 1).

In 1994, **Jane E. Buikstra** and **Douglas H. Ubelaker** published the widely used *Standards for data collection from human skeletal remains* as a part of Arkansas Archaeological Surver Research Series. This work gave a brief overview on the basics of coding commingled or incomplete remains, stressing that the procedure of recording commingled skeletal remains is slightly different from that of individuals' skeletons (Ubelaker & Buikstra 1994, 9). Another issue on standards was published in 2004 by **Megan Brikley** and **Jaqueline I. McKinley**. *The Guidelines to the standards for recording human remains* gave a more thorough overview of recording both demographic data as well as ancient modification and taphonomy of the remains (Brikley & McKinley 2004, 14-17).

In 2004 **Christopher J. Knüsel** together with **Alan Outram** published the article *Fragmentation: the zonation method applied to fragmented human remains from archaeological and forensic contexts* in *Environmental Archaeology*, stating that scattered and commingled human and animal remains are commonly encountered on archaeological sites and, that recording systems for human remains based on more or less complete individuals in an isolated context do not easily lend themselves to the fragmentary and commingled remains. Using Dobney and Rielly´s (1988) zone drawings and written descriptions as a basis, Knüsel and Outram developed a new methodology for recording commingled human remains. Yet another article was published by the pair as well as **Stephanie Knight** and **Anthony F. Harding** in the *Journal of Archaeological Science* titled *Understanding complex fragmented assemblages of human and animal remains: a fully integrated approach* in 2005. In the article it was stressed once again that standard approaches of studying human remains rarely lend themselves to the complete understanding of commingled contexts and also stating that some techniques more common in zooarchaeology could be beneficial when working with commingled human remains. Focusing on the bone deposits at the Middle Bronze Age ritual enclosure of Velim Skalka in Czech Republic, the authors gave a thorough overview of the issues of aging, quantification, identification, fragmentation and much more.

One of the first comprehensive books on the issue of commingled human remains is the *Recovery, analysis, and identification of commingled human remains* published by **Bradley J.**

Adams and **John E. Byrd** published in 2008. While focusing largely on more modern examples, the authors (together with other contributors) gave an in-depth report on handling and studying of commingled human remains. Adams and Byrd also published another book on the matter in 2014 titled *Commingled human remains: methods in recovery, analysis, and identification*, an even more comprehensive publication that handled the more common topics of MNI and cremains with those of GIS-based methods and other interdisciplinary views.

Another book was published in 2014 by **Anna J. Osterholtz**, **Kathryn M. Baustian** and **Debra L. Martin** titled *Commingled and Disarticulated Human Remains: Working Toward Improved Theory, Method, and Data*. The book presented preferable practices on the field using a case study approach. In 2019 Osterholtz published another article on the topic in *Advances in Archaeological Practice*. *In Advances in documentation of commingled and fragmentary remains* she introduced a new database designed to capture baseline data on vast collections of commingled and fragmented human remains.

Jennifer E. Mack together with **J. E., Waterman**, **A. J., Racila**, **A.M., Artiz** and **K.T., Lillos** published the article *Applying zooarchaeological methods to interpret mortuary behaviour and taphonomy in commingled burials: the case study of the Late Neolithic site of Bolores, Portugal* in the *International Journal of Osteoarchaeology*. On the basis of this article, a new kind of methodology was created, further illustrated in *Osteological Landmark Coding Guide For Commingled Human Remains* (Mack, 2015).

In 2016, three articles focused on commingled remains were published in the *Journal of Archaeological Science*. The first article, *Funerary taphonomy: an overview of goals and methods* by **Christopher J. Knüsel** and **John Robb**, concentrated more on taphonomic changes in human remains but also on the topic of bone census, NISP, MNE, MNI and element representation as well as giving many useful pointers on the management of commingled remains. The second article written by **Nicole Lambacher**, **Karina Gerdau-Radonic**, **Emma Bonthorne** and **Francisco J. V. de Tarazaga Montero** titled *Evaluating three methods to estimate the number of individuals from a commingled context* compared the already well-known methods of the traditional MNI (White 1953), the zonation system (Knüsel and Outram 2004) and landmark system (Mack et al., 2015) used on the commingled remains from the medieval cemetery of Santa Maria de Zamartze, Spain. The third article *What can we really say about skeletal part representation, MNI and funerary ritual? A simulation approach* was once again penned by **John Robb**, analysing the validity of MNI and skeletal part representation to the number of bodies deposited by creating a computer-based simulation.

Some research has also been performed on the commingled material from Estonia, most notably by Raili Allmäe, Mari Tõrv, Anu Kivirüüt and Liivi Varul as well as Jonathan Kalman. In her PhD thesis "*Iron Age Cremation Burials In South-Eastern and West Estonia. An Osteological Approach. (2017*)" **Raili Allmäe** studied the mostly cremated remains from Kaseküla stone-cist grave, Lihula stone grave, Keskvere II underground burial, Uugla I, II and III stone graves, Ehmja stone grave and Kirbla stone grave from Western Estonia as well as Põlgaste *tarand* grave, Suure-Rõsna and Rõsna-Saare I and II sand-barrow cemeteries and Kirikumägi flat ground cemetery from South-Eastern Estonia. (Allmäe 2017, 23-26) She provided a thorough analysis of the cremains, including assessing the minimum and probable number of burials and the population profile e.g. the sex and age-at-death (*ibid*., 42 - 44).

In her PhD thesis "*Persistent Practices: A Multi-Disciplinary Study of Hunter-Gatherer Mortuary Remains from c.6500 – 2600 cal. BC, Estonia (2016)*" among other topics**, Mari Tõrv** handled the issue of identification of loose human bones from assemblages scattered around occupation layers of settlement sites, providing the number of identifiable specimens (NISP), the minimum number of elements (MNE) as well as the minimum number of individuals (MNI) when possible (Tõrv 2016, 80).

Anu Kivirüüt studied the commingled and fragmented human remains from Viimsi I and II *tarand* graves as well as Võhma Tandemäe early *tarand* grave in her MA dissertation "*A comparative osteological and intra-site spatial analysis of tarand-graves (2014)*" while **Liivi Varul** continued her earlier work on Jõelähtme stone-cist graves during her MA dissertation "*Burial customs at Jõelähtme stone-cist graves: Results of the osteological analysis of graves nos. 1 – 9, 12 – 24 and 34 – 36 (2016)*".

Anthropologist Jonathan Kalman (2000b, 2000c, 2000d) has also done some research with Estonian material, some of the most notable examples being the osteological analysis performed on stone grave II of Tõugu, stone grave of Tandemägi and *tarand* grave of Uusküla II.

The study of commingled human remains clearly garners much more notice now than in the earlier days of anthropologic research when the topic was barely touched upon and has gained even more momentum during the last decade in both Estonia as well as abroad.

1.3 The archaeological context of the case studies

The following overview of the archaeological context of both Viidumäe and Lepna has been derived using the material (including reports and articles) compiled by archaeologist Marika Mägi who has been the lead researcher in both cases.

1.3.1 The archaeological context of Viidumäe

The archaeological research at Viidumäe started in 2014 and was continued throughout 2015 and 2016 (Mägi et al. 2015, 89; Mägi 2016-2020). The fieldwork was mainly supervised by Marika Mägi. Information about a possible archaeological site within the former Kihelkonna parish in west Saaremaa was received in the spring of 2014 but, unfortunately, the site had been by then already damaged by several groups of illegal metal detectorists (Mägi et al. 2014, 91).

Viidumäe is the highest and oldest point of Saaremaa, renowned for its sea cliff (Fig. 1) which indicates a shoreline dating from the Ancylus Lake period. Nowadays the Ancylus Lake has been replaced by a wetland area that stretches at the foot of the perched marine terrace (Fig. 2). During the Iron Age, this could have been a small lake filling up the former seabed that faced the paleo sea cliff (*ibid*., 91).

Figure 1. View to the cliff surrounding Viidumäe sacrificial place. Photo: Marika Mägi.

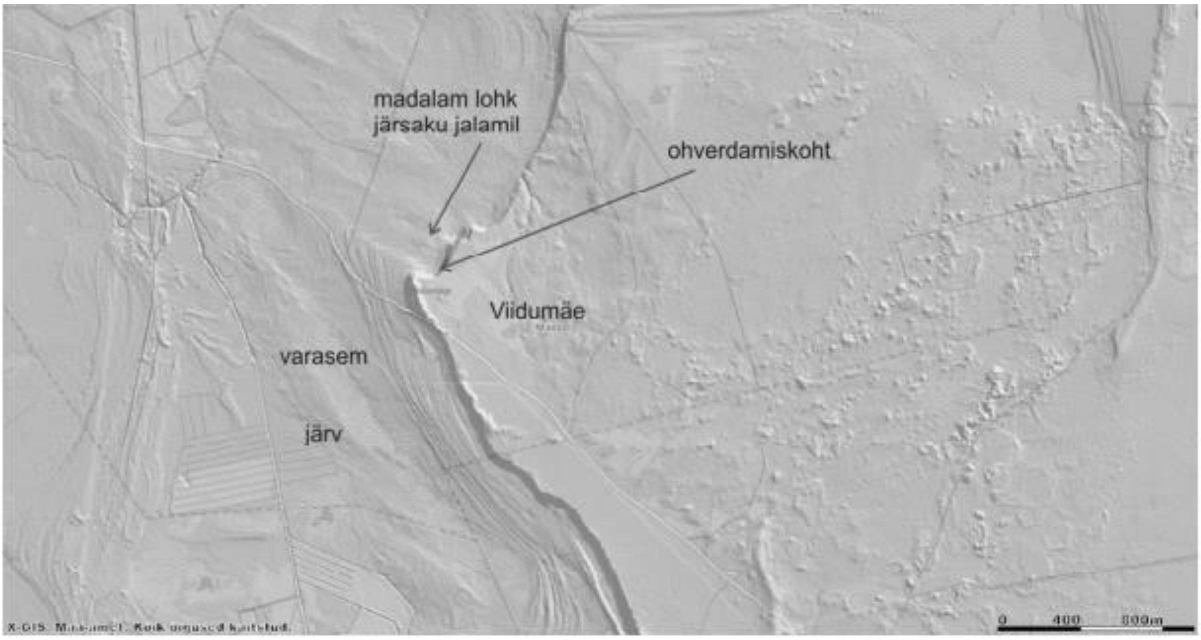

Figure 2. Orthophoto of Viidumäe sacrificial place. Varasem järv = paleo lake; madalam lohk järsaku jalamil = depression at the base of the cliff; ohverdamiskoht = sacrificial place. Photo: Maa-amet.

There are only few and small arable lands in the nearest vicinity of the Viidumäe site and in the east from it there is about a 10-km-broad zone void of any arable land. The site is situated about four or more kilometres from old, presumably prehistoric villages and about two kilometres from the closest present-day villages of Liiva and Audaku (Mägi et al. 2014, 92).

The remains of a stone platform (Fig. 3) were found on the SW side of the cliff. According to the remains, the platform was of an arc-like shape, about 13 m long and at its widest part about 5 m wide. The platform was built of clearly selected, round granite stones that were approximately 15 cm in diameter. No artefacts or finds referring to a cultural layer were found in that section. The stones at the SW-direction of the platform had been placed directly on the sand. In the lower part of the platform the stones had been laid in one row and in the top part in up to three rows. Some stones that might have broken from the platform and rolled down the cliff could be found in approximately 7 m radius of the platform (Mägi et al. 2015, 89).

Figure 3. Remains of the stone platform. Photo: Marika Mägi.

A wooden construction made of larger logs was discovered in the northern half of trench 3 (Fig. 4) at a depth of approx. 33 - 35 cm. One of the larger logs, which was approximately 15 cm thick, 70 cm long and 20 cm wide, lay in an O-W direction and a smaller log, approx. 50 cm long, 8 cm wide and 5 cm thick lay partly on the larger log in an N-S direction. The bottom layer of the N-side of the trench was denser than in other places and pieces of coal could be found on it. The logs, too, seemed to have spots of charring which could mean that the construction had, at one point, burned. The bottom layer of the S-side of the trench, however, largely consists of light-toned sand. Some processed pieces of wood with a circular cross-section (approx. 2-3 cm diameter) and a sharpened end were found on top of the logs with other wooden debris. It is plausible that the construction had at some point (perhaps during a fire) collapsed as some lightly burnt bones were also found in the area. ^{14}C analysis taken from the wood were dated in Poznań Radiocarbon Laboratory in Poland and yielded the following results - 1560± 30 BP (Poz75894) with the feasibility by OxCalv.4.2 of 68.2%: 430 AD (52,6%) / cal. 493 AD; 510 AD (5,4%) / cal. 518 AD; 528 AD (10,2%) / cal. 541 AD and with the feasibility of 95,4%: 420 AD (95,4%) / cal. 565 AD (Mägi 2016-2020; Mägi et al. 2015, 93).

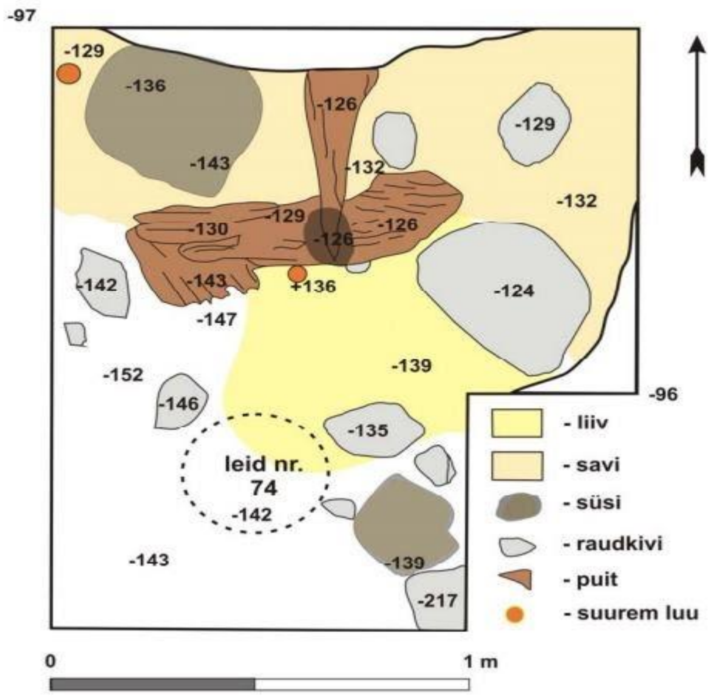

Figure 4. Drawing of trench no. 3. Liiv = sand; savi = clay; süsi = charcoal; raudkivi = granite; puit = wood; suurem luu = larger bone. Drawing: Marika Mägi.

Trench 3 was extended in 2016 and a new trench 6 was created and excavated in two layers. However, the finds of wood and charcoal were very similar to those gained from trench 3 in 2015 and some even closely resembled the worked wood found in the previous year but were not as well preserved. The remains of a burnt circular object were found from square 12/k (50) but in general, the number of finds was quite small - only an animal tooth and a mandible with teeth intact and with some smaller metal finds including fragments of a crossbow fibula (49) were found from trench 6 (Mägi 2016-2020).

In 2014, 58 metal finds, dating mainly from the period 600 - 900 AD were recorded by archaeologists. The weapon-related finds included arrowheads, spearheads, fragments of knives and a fragment of a scramasax. From jewellery, a bracelet with thickening ends and a head of a triangular-headed pin, decorated in early Nordic animal style were the most notable.
While most of the finds were of iron, some finds of bronze and silver were, according to information received, stuck into the sandy ground of the cliff (Mägi et al. 2015, 92-93).

A large number of finds were found in two distinct clusters laying 10 - 15 cm from the present-day surface (Fig. 5). This distribution, however, may have been caused by present day conditions (such as the area available to investigate via a metal detector or by the fact that mainly smaller iron items were left on the site) and may therefore be accidental but, at the same time, the clusters may refer to areas of ritual activity. Most of the finds, except two arrowheads and a single nail found with human bones, appeared to be without any closer context or detectable cultural layer around them. No ceramics were found by archaeologists or reported by the illegal detectorists. Overall, the area of the sacrificial place can be estimated to have measured about 1.5 ha and, according to the number of pits dug by illegal detectorists, most finds were concentrated to the western half of the cliff (Mägi et al. 2015, 92-93).

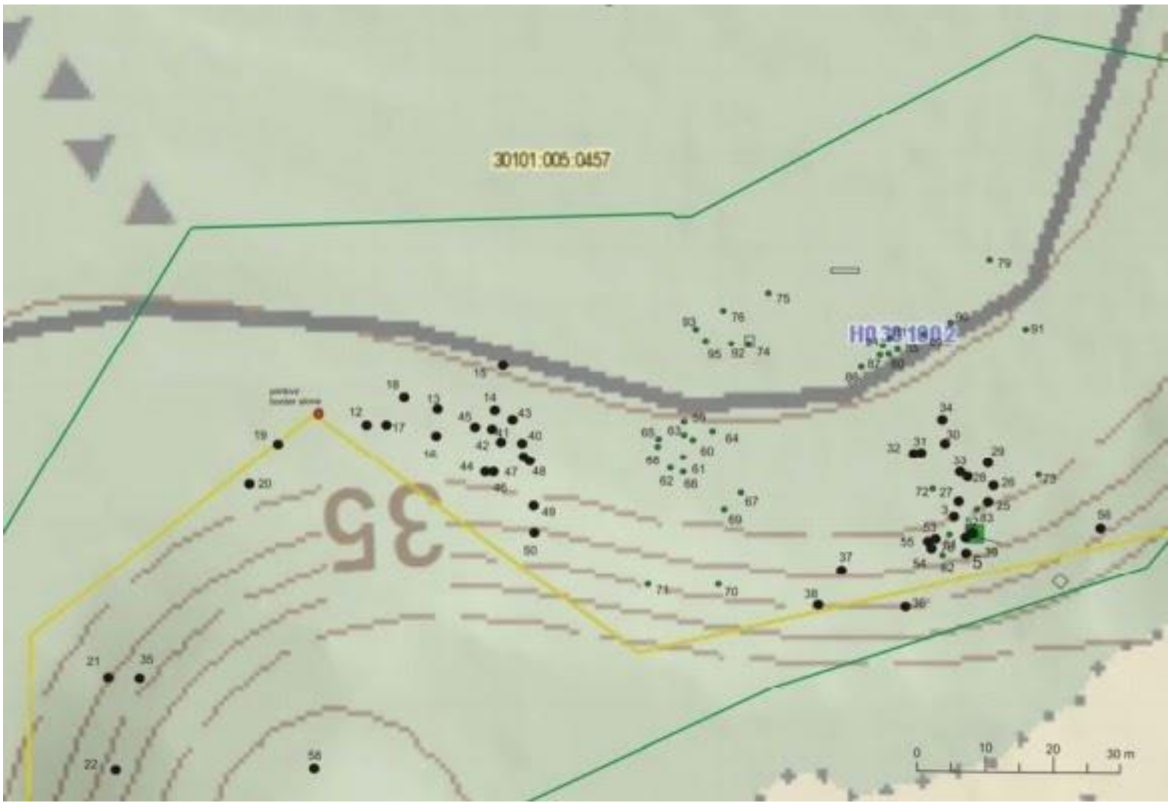

Figure 5. Trial excavations and finds at Viidumäe. Drawing: Riina Riiel-Mürk; Marika Mägi.

A cluster of uncremated but fragmentary human bones from several individuals was found approximately in the middle of the area investigated in 2014. The size of the oval ditch containing human bones measured 200 cm (NW-SE) x 50 cm (NE-SW) with the uppermost layer of this area having grown over by roots. The first bones were found at a depth of 15-20 cm as the soil turned sandy and it is expected that the depth of the pit had been approx. 40 cm below the surface at that time. Some bones were also detected in other trial pits in the same sector of the site, suggesting that there could have originally been several pits containing human remains (*ibid*.: 94 - 95).

The bones found in the ditch excavated were so tightly packed that it may be presumed they were buried after the flesh had decayed from them. This is also supported by gnawing marks of rodents visible on several bones which indicated that the bones might have been laying exposed on the surface for some time before being buried. Some bones were also recorded on top of the sandy soil just outside the ditch which could mean that the bones had originally formed a regular pile and the uppermost remains had either decayed completely or were removed by wild animals. No real grave goods were found together with skeletal material except for a few arrowheads and a big nail mentioned before. ^{14}C analysis from some of the bones gave a result of 1260±30 BP(Poz-67813) calibrated with OxCal v. 4.2 between 669 - 865 AD with a 95.4% probability (Mägi et al. 2015, 94 - 95).

The preliminary analysis of Viidumäe assemblage was performed by anthropologist Raili Allmäe. She identified the presence of both male and female remains in the assemblage. The occasional measurements showed that most likely five males and two females were part of the assemblage. Amongst the material were the remains of at least three non-adults, with the youngest being around 7 years old at the time of death. Allmäe also described some of the edged-weapon injuries such as the traumas to the frontal bone, the left maxillary bone and the right occipital bone (which later turned out to be a morphological variation) (*ibid*., 94–95).

1.3.2 The archaeological context of Lepna

The Katkuauk grave at Lepna is situated on the former coastline in Southeast Saaremaa near the western bank of river Maadevahe on a relatively high hilltop. It was discovered in the years 2000 - 2001 and the excavations took place in July of 2002 - 2003, led by archaeologist Marika

Mägi. Before the excavations, the area of the burial site was overgrown with bush, but it is known that the hilltop was used as a field before and during the Soviet times. The gravesite itself, however, remained untouched (Mägi 2002, 1). In the course of excavations, remains of what had been a partly wooden and stone construction came to light (Fig. 6), consisting of a central rectangular pit (80 cm lower from the surrounding ground) surrounded by a low wall made mainly of soil. The pit itself was bordered by a low, dry-laid limestone foundation measuring 8.8 m × 5.3 m. The complex has been interpreted as being possibly partly open or having a wooden wall without stone foundations as no stone constructions were found at the southern half of the SW wall. The building may also have had two openings in the shorter walls which can be interpreted as entrances (Mägi 2005: 103-104).

Figure 6. The remains of Lepna mortuary house. Photo: Marika Mägi.

The bottom of the central pit contained well-preserved flagstone pavement with traces of a hearth - a charcoal stain of 60 – 70 cm in diameter and some burned stones - found right beside the supposed entrance (*ibid*., 104-105).

The northern, NW and NE sides of the pit were bordered by a belt of debris approximately 1.5 m wide that yielded some bones and artefact finds. It has been interpreted as a possible belt of roof tiles which may have fallen under the eaves or inside the building as it started to fall apart. The belt of tile is situated approximately 1.5 meters from the northern and western sides of the pit and merges with the foundations surrounding the pit on the southern side (*ibid.*, 105).

The height of the building must have been quite small as the main area was only built about 8 cm into the ground, leaving the chamber standing only 1.2 – 1.5 m above ground even if it had a ceiling. However, it seems that the pit-house had been the most important part of the construction, given that most of the finds and bones were constricted in that area (Mägi 2005, 106).

In 2002 the whole area of the burial site - 57m2 - was opened but only the layers I and II were cleared and recorded in the N-side of the complex. Not many finds except for some late-dating animal bones were found in the first layer (Mägi 2002, 1-2). A larger number of finds, especially bones, could be found from a depth of 5 – 10 cm from the stone formations surrounding the outer part of the grave that were exposed in the W-side of layer II. While some finds consisting of a small spearhead, bronze belt buckle, a fragment of a shield boss and some fragments of a small clay pot together with some poorly preserved fragments of bones from the NW-quarter of square 16/I were interpreted as a singular burial, the other finds do not seem to be closely connected to the vague stone boundaries of layer II (*ibid.*, 4-5). The NW-SO-oriented depression in the middle of the site was only cleared partly at a maximum depth of 60 cm in 2002. Many finds and bones were collected from the wall base, collapse layer and the depression of the grave. The finds seemed to be distributed without any clear regularity, but it is noted that a larger number of artefacts were found from the slope of the collapse layer and more bones from the depth of the depression reached in 2002 (*ibid.*, 6).

The work was continued in 2003 in the S-half of the excavation pit in squares 5-13/e-u. Some bones and artefacts were found in the square 10/o as well as 11-12/t-u of layer II, otherwise the layer was quite bare of bones and artefacts (Mägi 2003: 1-3). More finds were unearthed from the depression in the middle of the gravesite that had been noticed earlier in 2002 (ibid.: 4). During the excavation of layer III it became clear that the depression was a burial chamber with a well-preserved limestone floor and with the internal measurements of 7,75 m (NW-SO) × 4,25 m (NO-SW). A fireplace noticed in layer II was cleared fully in layer III. The fireplace that stretched over squares 10-11/r-s had a diameter of 60-70 cm and a thickness of 10-15 cm in layer III. A large amount of human bones together with artefacts were recovered from the area just SW from the fireplace under horizontal limestone slabs (*ibid*., 7-8).

The preliminary reconstruction of the burial place, according to ethnographic parallels, indicates that the remains of the building may have been from a drywall building with a dug-in floor and a roof supported by a wooden beam framework. The burials, or parts of them, might have been brought into the burial chamber wrapped in some sort of cloth or leather or placed in a vessel made of organic material. Some of them could have been placed under the eaves of the building while others could have been deposited on the floor and covered with slabs of limestone (*ibid*.: 11-12).

As stated before, most of the finds - bones and artefacts - were found either from along the walls of the pit or from within the wall debris (Mägi 2005, 118). Altogether 518 artefacts or fragments of them, including belt buckles, shield rivets, spiral rings and bracelets, chain holders, crossbow brooches etc. in different materials such as iron, bronze, and silver as well as many fragments of pottery were recovered from Lepna. The finds now reside at Saaremaa Museum under the main number of 10372 (Mägi 2003).

The preliminary osteological research on the remains from Lepna was performed by anthropologist Jonathan Kalman in 2002. Kalman noticed the fragmentary and poor preservation of the remains, believing the main taphonomic causes to be either acidic or alkaline soil conditions and exposure to elements such as sunlight, water, wind and crushing.

From developing dentition Kalman identified 4 non-adults: (1) 3.5–4.5, (2) 6–8, (3) 10–12 and (4) a 12–15-year-old children. Three infants were identified from single long-bone fragments and a child of 2–3 years was identified from a femur. On the basis of dental wear, Kalman identified that adults of different age groups: (1) 20–30, (2) 30–40 and (3) 40+ were present. A person of advanced age (around 50 years) was identified by observing the sutures of cranial fragments. Most of the fragments, however, had relatively open sutures, therefore suggesting an age of young to mid-adult (20–30). The MNI was calculated from the right petrous part of the temporal bone of the skull as this was one of the most common identifiable bone found in the assemblage. Kalman successfully identified four of the pars petrosa to having belonged to adults above 15 years of age (Kalman 2002, 1–3).

Kalman also offered two potential scenarios to consider for possible burial practices. First, he suggests that this deposit is an outcome of multi-episodic burial practices, meaning that the bodies were first buried elsewhere to decompose above ground and after that they were broken and placed or scattered in the grave. According to the second scenario the bodies were originally buried in the grave where they were left to decompose, and later parts of the bones were broken and removed from the grave or scattered (*ibid.*, 1–3).

Jana Limbo-Simovart analysed the teeth from Lepna in the article "The Frequency and Pattern of Dental Caries in Archaeological Populations From Estonia" (2013). Alongside Lepna, burials from Jõuga, Pada, Tääksi, Pärnu and Hargla were studied. Considering the fragmentary state of the remains at Lepna, only the fully developed teeth with clear signs of attrition were analysed. With 14 teeth out of 203 (6.89%) showing signs of caries, the total incidence of caries was the lowest in Lepna, which was also the earliest sample studied (Limbo 2013, 123-124).

2. Methods and Materials

2.1 Methods

2.1.1 Minimum Number of Individuals (MNI)

To calculate the minimum number of individuals the principles of MNI (White 1953) were followed. MNI presents the minimum number of individuals that contributed to the sample and is the most widespread method of quantification in any type of commingled osteological analysis both human and animal (Adams & Byrd 2008, 43). This method is based on the sorting and siding of a singular skeletal element. For example, if a certain amount of both right and left humeri are collected, the side with the largest number of elements will represent the number of individuals in the collection.

In order to calculate the population size from fragmentary remains, specific segments of an element, for example, the proximal end of a femur, can be used to calculate the MNI. It is, however, important for every fragment to share a distinct landmark to ensure that they do not originate from the same skeletal element as the basic principle of an MNI estimate is to avoid counting the same individual twice (ibid., 243, Adams & Byrd 2014: 195).

Much as the method has been widely used and has proven reliable more often than not, it may include some drawbacks, especially when dealing with highly fragmented and taphonomically affected assemblages. These pitfalls are mainly concerned with differential preservation and post-burial effects on assemblages based on the MNE (Minimum number of elements) as both natural taphonomic processes as well as social behaviours, such as differential treatment of skeletal elements and processes involving the destruction of some skeletal elements that may be a part of a multi-stage burial processes, can affect the results gained from using the traditional MNI in a negative matter (Knüsel & Outram 2016, 6).

There is a possibility of underestimating the number of people contributing to the assemblage when using the traditional method of deriving MNI, especially unless all of at least one type of skeletal elements are recovered during excavations. This may also happen in the case of near-complete recovery (Adams & Byrd 2008, 243–244, Adams & Byrd 2014, 195–196).

Another variant of the standard MNI, sometimes referred to as the grand minimum total, is calculated as $L + R - P$, where P signifies the number of bone pairs, with the unpaired elements from different sides assumed to come from different individuals. This method is thought to provide a higher estimate than the standard MNI does (Adams & Byrd 2014, 197).

As the remains from both Viidumäe and Lepna are severly damaged and the standard MNI is the most straightforward in terms of use, it was the chosen method for this study.

2.1.2 Age-At-Death Estimation

2.1.2.1 Non-adult Age-At-Death Estimation

The calcification and eruption of teeth are considered to be the most accurate indicators of biological age in non-adults as dental development is strongly controlled by genetics and has minimal influence from the environment the child lived in (Buikstra & Ubelaker 1994, 63). Dental development is also widely used due to teeth being often found in forensic and archaeological context and because the formation and eruption times of teeth are very regular (White et al. 2005, 364).

Deciduous, or baby teeth, begin to mineralise in the jaw already at around 15 weeks of gestation, starting with the maxillary central incisors and continuing until all deciduous teeth have fully erupted around the age of three. Secondary (permanent) dentition develops throughout the time of birth until around 14 years of age. The most variable element of dentition is the third molar, which erupts roughly around the age of 17, ending the cycle of teeth formation (Lewis 2007, 38).

The method used on the non-adult dentition of both Viidumäe and Lepna was the dental age estimation chart by Ubelaker (1978), which is loosely based on the atlas by Schour and Massler (1941). The Schour and Massler atlas (1941) is possibly developed on the basis of anatomical and radiographic sources but few details of the sample are known. It was published as an attachment in the *Journal of the American Dental Association* and featured a series of 21 drawings from in-utero to adulthood. Ubelaker (1978), in turn, corrected the age range for each drawing by including numerous published sources and defined the line as gingival emergence (AlQahtani et al. 2014, 1)

2.1.2.2 Adult Age-At-Death Estimation

Methods of age-at-death estimations for adults are extensive, including cranial suture closure, parietal thinning, pubic symphysis metamorphosis, changes to the auricular area and acetabulum of the pelvis, development of sternal rib ends, osteoarthritis including osteophytosis, overall degenerative changes and dental and bone histology features (Ubelaker & Khosrowshahi 2019, 1) Due to the character of the here-analysed remains, the methods based on skeletal elements could not be used to their full potential and were therefore not applied to these assemblages. Instead an emphasis was put on the methods based on the changes in adult dentition.

When assessing the age at death from adult dentition Brothwell´s (1963) classification that is based on the wear patterns on premedieval British teeth was followed. The method is based on the abrasive action that teeth are exposed to during masticatory processes as they continually rub against each other and against rough particles that may be contained in the consumed food. This, in turn, will eventually wear down the occlusal surfaces of the teeth, destroying the cusp patterns and eventually exposing the dentin underneath enamel. Assessing the wear of the molars can, therefore, be useful in estimating adult age-at-death (Bass 2005, 298).

2.1.3 Sex Estimation

In biological and forensic anthropology, as well as osteoarchaeology, the anthropologists determine biological sex. One should not confuse sex with gender, as gender is a cultural construct that refers to the social importance placed upon the males and females in society. (Lewis 2007, 47). While there are many different methods for estimating the biological sex of skeletal remains, the techniques generally fall into one of two categories. While some methods focus on the size and robusticity of skeletal features, others mainly observe the morphology of the pelvis as it is closely tied to the ability of females to carry children (Ubelaker & DeGalia 2017, 407.e1).

As a rule, for all parts of the human skeleton, female skeletal elements are characterized by their smaller size and lighter construction whereas the largest, most robust elements with the heaviest rugosity are considered to male as males can average up to 20% larger in some skeletal dimensions (White et al. 2005, 386). This difference in size is due to sexual dimorphism of the skeletal elements which begins during the development of the fetus and becomes evident during puberty. Sexual dimorphism relies on the distribution of hormones, especially testosterone, that influence the shape and size of the skeleton (Lewis 2007, 47). However, normal biological variation always produces some small, gracile males and large, robust females (White et al. 2005, 386).

When all cranial and postcranial traits are used, the accuracy of sex determination in adult skeletons can reach 98–100% (Lewis 2007, 48). Because the sexual differences in immature skeletons of non-adults are not sufficiently pronounced (Ubelaker & DeGalia 2017, 407.e1) most methods fail to yield an accuracy of 70% (Lewis 2007, 48).

In order to assess the sex from cranial morphology in this study, the mastoid process, prominence of the glabella, supraorbital margins, and the mental eminence were viewed macroscopically. These are well known sexually dimorphic elements of the skull and tend to be larger in males than in females. In the process of estimating the sex the element was compared to the standard provided by Ascádi & Nemeskéri (1970) in which the element is scored from "1" to "5", the minimal expression being scored a "1" (most likely female) and the maximal expression being scored a "5" (most likely male) and unobservable traits receiving a score of "0".

While the dimorphic features of the postcranial skeleton are well documented, they are less consistent that those of the pelvis and cranium and the accuracy of sex identification from postcranial skeleton is reduced by the overlap between the ranges of males and females even in the same population. (Buiksta & Ubelaker 1994, 54). In the case of both Viidumäe and Lepna the only postcranial sexually dimorphic features that could be used were the measurements of long bones that were taken when possible. The measurements from femurs were compared to data from Pearson (1917–1919) (from Bass 2005, 230) who has given measurements for the vertical diameter of the femoral head, the popliteal length of the diaphysis, bicondylar width and trochanteric oblique length, which proved to be useful when dealing with fragmented remains as well as the measurements of long bones given by Garmus & Jankauskas (1993). Besides long bone lengths, the measurements of the calcaneus and talus were taken into count when possible and consulted with the estimations given by Garmus (1996) and the femoral head circumference as well as the distal width of the humerus after the estimations given by Nainys (1972).

2.1.4 Pathology

Pathologies referring to trauma a.k.a. injury to living tissue caused by a mechanism or force extrinsic to the body, whether incidental or intentional (Lovell 2008, 341) were also viewed macroscopically. The affected bone or bone fragments were documented and sided with the measurements, including the length and width, taken with a digital micrometre.

While traumatic injuries are some of the most common pathological conditions noticed in human skeletons, it was important to learn how to correctly differentiate between perimortem and post-mortem injuries. Post-mortem defects seen on old bones can be easily identified due to a colour difference between the bone´s surface (which is usually darker) and that of the area exposed by the lesion (usually lighter). These colour differences are usually brought on by discolouration produced though prolonged contact with the surrounding soil. Cutmarks that are lighter than the overall colouration of the surface of the bone can therefore indicate that the damage occurred long after death, perhaps during archaeological excavation or museum curation. On the other hand, signs of healing around the injury are clear evidence that the injury occurred before death. (Walker 2001, 576-578).

When describing sharp force trauma, a tentative reconstruction was given, in which the type of lesion as well as the direction of the blow was identified. The categories of sharp force injuries include slashing, chopping and stabbing wounds. The first type of lesion commonly occurs when a heavy bladed implement (weapon) enters the tissue at an angle perpendicular to the axis of the blade with the combined aid of its own kinetic energy as well as applied force. This also applies to cases where the body falls upon a sharp edge, or when a descending or thrown sharp implement´s blade collides with the body. Slash wounds occur when a bladed instrument enter the tissue tangentially with its force both parallel and perpendicular to its axis while stab wounds take place when a generally long and pointed implement enters the tissue with a force applied parallel to its long axis (Marton et al. 2015, 1).

However, as stated with the issues affecting the pathologies caused by diseases, commingled assemblages also inevitably undermine palaeopathological considerations associated with trauma, as it is not possible to combine evidences from different skeletal districts. This, ultimately, affects any conclusive differential diagnosis (Figus et al. 2018, 387).

2.2 Materials

2.2.1 Processing of the Remains

The first procedure for the processing of the remains from both sites was sorting of the bones to locate the elements which could be useful for the project. These elements include the proximal and distal ends of long bones, tarsal bones, and cranial fragments along with teeth. The fragments usable for the identification of sex and age-of-death were separated, labelled, identified, and sided.

It was decided that the petrous portion of temporal bone would be the key in evaluating the minimum number of individuals (MNI) as this part of the temporal bone has high rates of survival in taphonomic contexts (Kozerska et al., 2018, 35). The petrous parts were collected and sided with the data gathered, which are added to tables (Table 1, Table 11).

With the remains from Lepna, the job of separating animal bones from human bones that the previous researchers started was finished. The faunal remains were collected and packaged separately from human remains and marked with necessary information.

The fragments of cremated bones of Lepna were collected and labelled with each fragment measured and identified when possible. The data alongside with the physical description of the fragments (colour, cracking) were taken by eye as complimentary information and added to a table (Table 17).

The bones and bone fragments from non-adults were located, identified, and sided.

The teeth from both sites were located and collected. All teeth that were found separately and in maxilla/mandible were added to the tables found in the appendix. When possible, the teeth were identified and sided with the molars, teeth with developing roots and deciduous teeth used in the process of estimating the age groups contributing to the assemblages. The teeth, as well as surviving maxillae and mandibles, were studied for possible dental pathologies such as dental calculus, caries and antemortem tooth loss along with other abnormalities such as enamel pearls and extra roots.

All bone fragments were studied for signs of lesions associated with sharp force trauma and subsequent morphological changes. The fragments with notable pathological changes were identified, sided, and photographed. The photographs of the pathologies from both assemblages were taken by Jaana Ratas using a Canon EOS 5D Mark II camera and a Tamron 90 mm lens. The lesions caused by sharp-force trauma were measured by a digital caliper.

2.2.2 Limitations to the Methodological Approach

The greatest issue when interpreting the assemblages from both collections is their highly fragmentary nature that drastically limited the number of methods that could be used in determining sex and age-at-death of the individuals.

The fragmentation was greater in the assemblage from Lepna where the diaphyses of most long bones have reduced to shards, measuring only a few centimetres with the edges having warped over time, rendering them impossible to restore. Only one long bone could be salvaged in its full length and measured.

In many cases, the epiphyseal ends that could have been used to assess the age of non-adults had fragmented or had lost the coat of compact bone. Because of these circumstances, it was impossible to obtain reliable measurements from a large portion of the assemblage.

Due to the fragmented and commingled state of the pelvic bones, features such as the general size and shape of the pelvis, the subpubic angle, the width of the greater sciatic notch, ventral arc, subpubic concavity, breadth of the medial surface of the ischiopubic ramus, and preauricular sulcus, which are key in determining the sex of the skeleton (Ubelaker & DeGalia 2017, 407.e1), were unusable. In relation, the pubic symphysis which is an important element in assigning age-at-death in adults, could not be used as there were no complete pubic symphyses found in neither of assemblages.

The severe taphonomic influences were also problematic when analysing teeth found from both Lepna and Viidumäe, as many teeth had either lost their enamel or roots. This affected the possibilities of siding or even identifying the teeth based on their morphological elements.

The identification of pathological alterations on bone was also affected by taphonomic influences, as the poor preservation of cortical bone means that not all lesions and diseases affecting the outer layer of bone may not have survived.

In the case of Lepna, the human remains had not only commingled with each other but also with animal bones. This hindered the recognition of bones from non-adults as they might look similar to those of animals, especially in their fragmentary state.

3.Results

3.1 Case study I – The Commingled Remains from Viidumäe

The osteological assemblage of Viidumäe consists of 6 boxes of bones and was in various states of preservation (Fig. 7). The bones were packaged in plastic Ziploc bags with the identification number or area marked on the bags. There were also loose bones in the bottom of some boxes which were collected and marked accordingly (e.g. the loose bones from a box containing mainly material from area 11 was marked as “loose bones from box 11”) or remained in the material as NI (e.g. no information).

Complete long, flat, and irregular bones could not be found in the assemblage as they have all fragmented in a larger or smaller scale. The long bones are mainly broken from both epiphyseal ends and often along the diaphysis. Flat bones, such as those in the skull and pelvis, have also fragmented in a way that makes it impossible to reconstruct the whole bone. Irregular bones, such as the vertebrae, are, in most cases, fragmented through the vertebral foramen. Only some small bones such as the foot and wrist bones were intact.

Altogether 208 teeth could be found in the assemblage, 35 in alveolar bone (15 in maxilla and 21 in mandible) and 173 loose teeth. 29 of the teeth, including 9 deciduous, belonged to non-adult and 79 to adult dentition. Several teeth had either chipped enamel or broken roots.

Figure 7. Remains from the Viidumäe assemblage. 1 = packaging of the remains; 2 = some femora frome Viidumäe; 3 = state of fragmentation. Photo: Maris Niinesalu.

3.1.1 Population profile

3.1.1.1 Minimum Number of Individuals (MNI)

In the assemblage from Viidumäe, 17 petrous parts of the temporal bone were found (Table 1) from which eight (n=8) were assigned to the right side and nine (n=9) to the left. Thus, it is possible to conclude that the MNI of Viidumäe assemblage, based on the petrous part of the temporal bone, is nine (n=9).

Table 1. The pars petrosa from the Viidumäe assemblage.

ID	Side	Age
NI	L	Adult
SW9	L	Adult
W12	L	Adult
4,5 + child	L	Non-adult
NI	L	Adult
16	L	Adult
15	L	Adult?
16 middle	L	Non-adult
S	L	Non-adult
W12	R	Adult
17C	R	Adult
4,5 + child	R	Non-adult
SW9	R	Adult
15	R	Adult
W10 middle	R	Adult
16 middle	R	Adult
16 middle	R	Adult
W8	R	Adult

The MNI derived from the petrous part of the temporal bone is supported by the amount of some of the other bone parts used as landmarks from the Viidumäe assemblage. Nine (n=9) right proximal parts of the femur as well as distal parts of the humerus were found. The MNI derived from the other landmarks, such as the distal part of the femur, the proximal and distal parts of the tibia, the proximal part of the humerus, the patella, calcaneus, and talus ranges from three (n=3) to eight (n=8). These numbers, however, may be because of the poor preservation of bone material, as some of the proximal and distal parts of the bones may not have survived or were rendered unsideable.

The standard procedure of recording MNI does not, however, consider the number of adult and non-adult individuals in the assemblage. From the proximal ends of the femur, four (n=4) belonged to the right side and four (n=4) to the left (Fig.9). The bones belonging to three individuals were successfully paired; the measurements (Table 2) of one proximal end of a femur belonging to the right side as well as one belonging to the left side did not allow them to be assigned to the same individual. Thus, it can be derived that at least five (n=5) non-adults contributed to the assemblage.

Table 2. Measurements of the non-adult proximal femorae from Viidumäe.

ID	Side	Width of the femoral neck (mm)	Width of the proximal diaphysis (mm)

17	R	20.38	25.72
17	L	19.83	25.16
17	R	22.56	28.34
15	L	22.80	28.45
16	L	20.10	26.90
15	L	20.56	-
NI	R	17.19	-
NI	R	22.76	24.56

Figure 8. Non-adult proximal ends of femorae. Photo: Maris Niinesalu.

However, all of the tali found in the Viidumäe assemblage and sided to the right side belonged to adults (Table 3), which means that the collection includes at least eight (n=8) adults and five (n=5) non-adults, giving the comprehensive MNI value of thirteen (n=13).

Table 3. The MNI values derived from the Viidumäe assemblage.

Bone	MNE	R	L	NI	Non-adult	MNI
Femur prox.	16	9	6	1	4	9
Femur dist.	11	3	3	5	0	3
Tibia prox.	5	2	2	1	0	3
Tibida dist.	9	3	4	2	0	5
Humerus prox.	4	3	1	0	0	4

Humerus dist.	14	9	5	0	3	9
Patella	9	5	4	0	0	5
Calcaneus	6	2	4	0	0	4
Talus	14	6	8	0	1	8
Pars Petrosa	18	8	9	0	2	9

3.1.1.2 Sex Estimation

Bone measurements for sex estimation were taken opportunistically from bones or bone parts that had survived to the extent so the accurate data could be obtained. The measurements considered in deriving an estimation of sex were the length of the calcaneus, the length of the talus, the circumference of the femoral head, the bicondylar width of the femur, the distal width of the tibia and the distal width of the humerus.

Only three (n=3) calcanei were complete enough to yield accurate measurements with one (n=1) of them sided as belonging to the right and two (n=2) as belonging to the left (Table 4). From the measurements obtained, it can be said that at least one (n=1) male and one (n=1) female contributed to the assemblage.

Table 4. Sex estimation from the calcanei from Viidumäe assemblage after Garmus (1996)

ID	Side	Calcaneus length	Sex
11	R	76 mm	F
17	L	83 mm	M
6	L	74 mm	F

Four (n=4) right and three (n=3) left tali were complete enough for accurate measurements (Table 5). Of the four right tali, two (n=2) yielded measurements in the range of belonging to females and two (n=2) belonging to males. From the three left tali, one (n=1) can be appointed to as belonging to a female and two (n=2) to males. Relying on the results it can be concluded that at least two (n=2) males and two (n=2) females contributed to the assemblage from Viidumäe.

Table 5. Sex estimation from the tali from Viidumäe assemblage after Garmus (1996)

ID	Side	Talus length	Sex
SO7	R	48 mm	F
11	R	56 mm	M
NI	R	54 mm	F
16	R	56 mm	M
6	L	53 mm	F
17	L	59 mm	M
15	L	57 mm	M

Four (n=4) femoral heads were measured for their circumference (Table 6) with two (n=2) assigned to the right and two (n=2) to the left side. All the four (n=4) femoral heads were large enough to be perceived as belonging to males. This suggests that the remains of at least two (n=2) males are found from the Viidumäe assemblage.

Table 6. Sex estimation from the femoral head circumference from Viidumäe assemblage after J. V. Nainys (1972)

ID	Side	Femoral head circumference	Sex
16	R	159 mm	M
SO7	R	156 mm	M
15	L	162 mm	M
W10 middle	L	152 mm	M

In the case of the femoral bicondylar width measurements (Table 7), five (n=5) elements were measured with two (n=2) of them sided as belonging to the right side and three (n=3) to the left. The measurements of two (n=2) distal ends from the right side could be assigned to belong to females and all three (n=3) of the distal ends from the left side to males. By the measurements of the femoral bicondylar width the remains of at least two (n=2) females and three (n=3) males can be found from the assemblage.

Table 7. Sex estimation from the femoral bicondylar width from Viidumäe assemblage after Pearson (1917 – 1919) (from Bass 2005, 230)

ID	Side	Femoral bicondylar width	Sex

16	R	70 mm	F
17	R	78 mm	F
SO7	L	83 mm	M
NI	L	84 mm	M
NI	L	79 mm	M

Three (n=3) right tibiae and three (n=3) left tibiae were measured for their distal width (Table 8) out of which all three (n=3) of the left-sided distal tibiae measured as belonging to females. Two (n=2) of the right-sided distal tibiae also measured as belonging to females and one (n=1) of the right-sided distal tibia measured as belonging to a male. Results allow to assume that at least one (n=1) male and three (n=3) females contributed to the assemblage.

Table 8. Sex estimation by the distal width of the tibiae from Viidumäe assemblage after Garmus & Jankauskas (1993)

ID	Side	Tibia distal width	Sex
15	R	41 mm	F
17	R	55 mm	M
So7	R	46 mm	F
11	L	50 mm	F
11	L	48 mm	F
15	?	42 mm	F

Only two (n=2) distal parts of the humerus were complete enough for their distal width to be measured (Table 9). Both bones were sided as belonging to the right side and both of their measurements could be assigned to females.

Table 9. Sex estimation from the distal width of the humeri from Viidumäe assemblage after J. V. Nainys (1972)

ID	Side	Humeral distal width	Sex
15	R	51 mm	F
15	R	52 mm	F

From the measurements and data gathered, it is assumable that in total, the remains of at least three (n=3) males and three (n=3) females could be found in the Viidumäe (Fig. 9). However, these numbers should be considered more as the Minimum Number of Males and the Minimum Number of Females contributing to the assemblage as the remains of nine (n=9) adults were derived from the standard MNI.

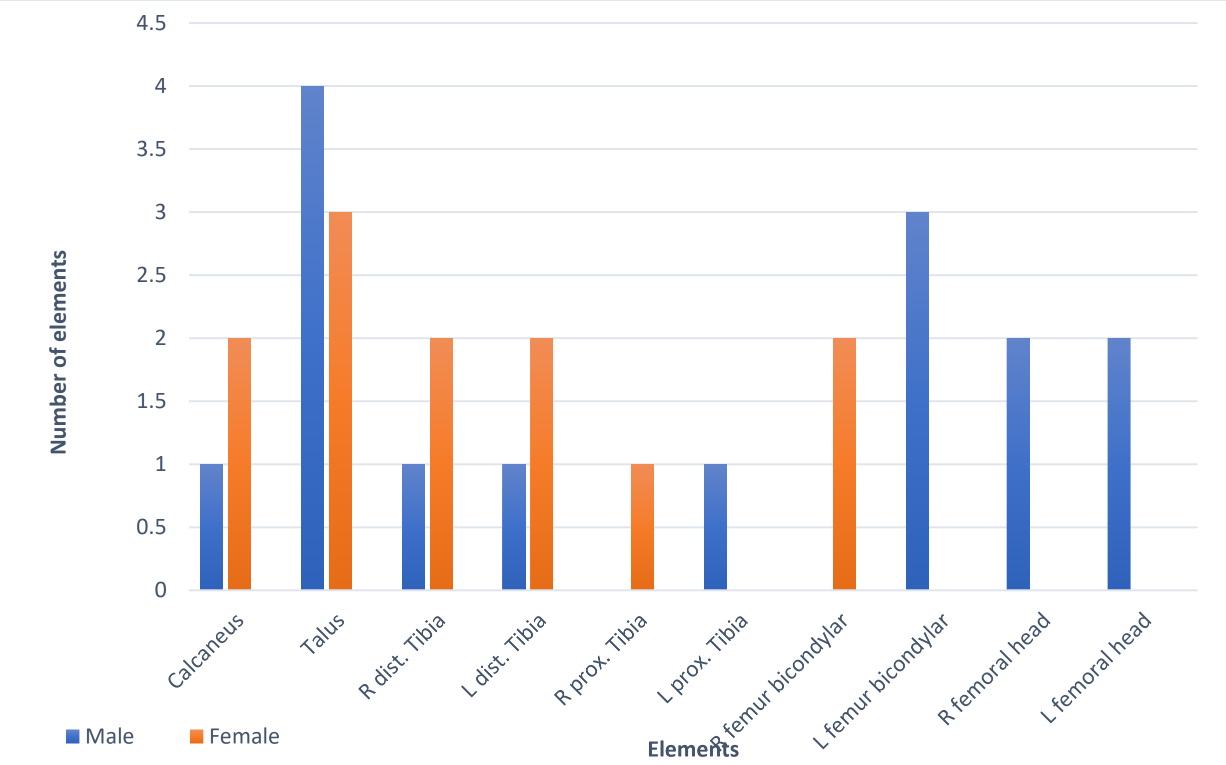

Figure 9. Estimation of minimum number of males and females in the Viidumäe assemblage from skeletal elements.

3.1.1.3 Age-at-death estimation

The age estimation for adults was derived from the wear of the molars (Fig. 10). Altogether, 87 molars were studied to assign age from the wear of the occlusal surface according to Brothwell (1963). At least eight (n=8) individuals could be placed in the age category of 17–25 based on the tooth wear, while at least three (n=3) individuals could be placed in the age category of 25–35. Only one tooth, a first mandibular left molar (1LLM), had been worn to an extent where it could be placed in the age category of 35–40. However, all the other molars could be placed into younger age groups for different reasons such as preferential chewing which will be addressed in discussion.

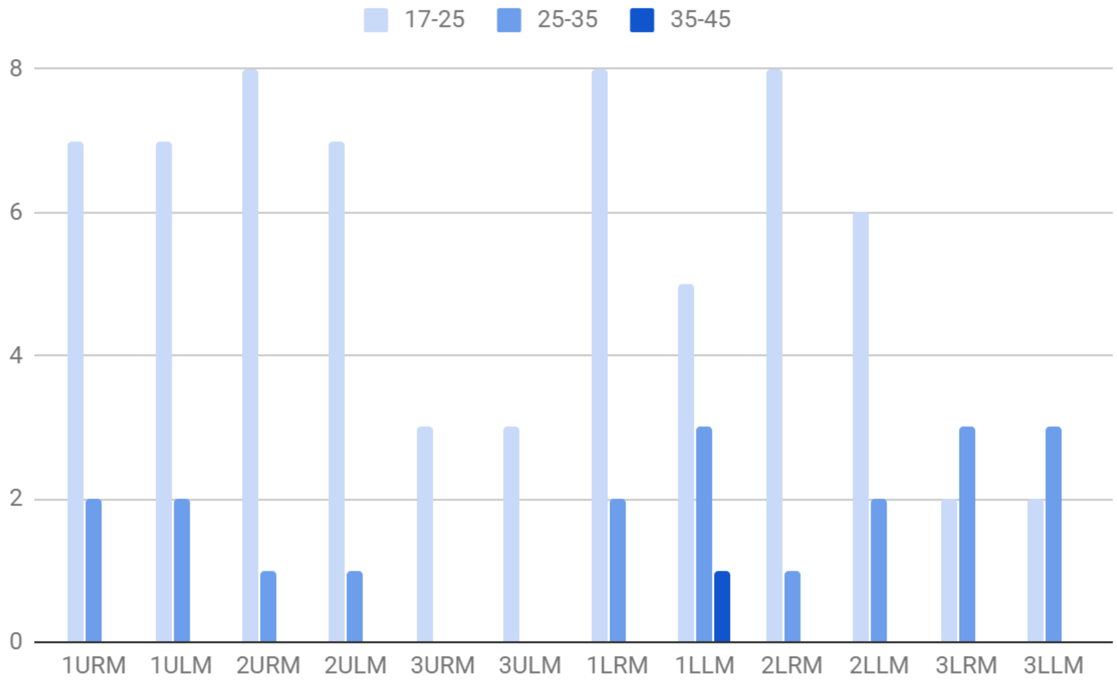

Figure 10. Estimation of minimum number of people contributing to age groups from the molars from Viidumäe.

From the Viidumäe assemblage, 27 teeth belonging to non-adults were identified (Table 10). Out of those 27 teeth, 7 were deciduous and 20 permanent. Based on the first deciduous right mandibular molar (1LRdM), at least three children can be identified from the assemblage with two of them in the age range of 6–10 and one in the age range of 5–9. From the first right mandibular molar (1LRM) said it is assumable that at least two children aged between 4–8 contributed to the assemblage while from the second right mandibular molar (2LRM) it is assumable that at least two children aged between 5–9 contributed to the assemblage of Viidumäe.

Table 10. The non-adult dentition with age assessments from Viidumäe assemblage after Ubelaker (1989)

ID	Tooth	No.	Age	Range
4,5+child	2LRdM	T	6±24k	4 – 8
4,5+child	1LRdM	S	8±24k	6 – 10
4,5+child	1LRdM	S	8±24k	6 – 10
4,5+child	LRdC	R	7±24	5 – 9

4,5+child	2LLdM	K	7±24	5 – 9
4,5+child	1LLdM	L	7±24	5 – 9
4,5+child	1LRdM	S	7±24	5 – 9
PERMANENT				
W8 (2)	1LRM	30	6±24k	4 – 8
Loose bones in the middle of 11	2LLPM	20	7±24k	5 – 9
Loose bones in the middle of 11	LRC	27	7±24k	5 – 9
12W middle	Premolar		9±24k	7 – 11
W middle 12 (2)	1URPM	12	8±24k	6 – 10
11	LLC	22	6±24k	4 – 8
4,5+child	1LRM	30	6±24k	4 – 8
4,5+child	2LRM	31	7±24k	5 – 9
4,5+child	2LRM	31	7±24k	5 – 9
4,5+child	2URM	2	7±24k	5 – 9
4,5+child	1LRPM	28	8±24k	6 – 10
4,5+child	1URPM	12	7±24k	5 – 9
4,5+child	LRC	27	8±24k	6 – 10
4,5+child	URC	6	8±24k	6 – 10
4,5+child	2LRI	26	6±24k	4 – 8
4,5+child	2LLI	23	6±24k	4 – 8
4,5+child	1URI	8	8±24k	6 – 10
4,5+child	2LLM	18	7±24k	5 – 9
4,5+child	1LLM	19	7±24k	5 – 9

3.1.1.4 Trauma

One of the most striking sharp force traumas can be observed on the frontal bone of a possible male from the Viidumäe assemblage (Fig. 11 & 12). The lesion, which is 42.53 mm long, has penetrated the frontal bone in a straight horizontal line, coming to a stop in the middle of the bone parallel to the glabella. The blow was delivered to the left side of the frontal bone, where the maximum thickness of the bone is 9.50 mm, thus, penetrating the brain, resulting in the death of the victim.

Figure 11. Sharp-force trauma to the frontal bone. Photo: Jaana Ratas.

Figure 12. Sharp-force trauma to the frontal bone. Photo: Jaana Ratas.

The sharp force trauma to the left mastoid process of a possible female (Fig. 13) is 14.64 mm in length, removing the tip of the mastoid process and possibly a part of the left ear. The blow was likely delivered in a downwards motion from an elevated position with the assailant standing behind the victim.

Figure 13. Sharp-force trauma to the mastoid process. Photo: Jaana Ratas.

The trauma to the maxilla from the Viidumäe assemblage (Fig. 14) is a 34.12 mm x 14.53 mm lesion from a sharp-edged weapon to an individual 25-35 years of age. The strike was directed from above, shaving off part of the alveolar bone and most likely the first maxillary incisors. It is assumable that the nose was affected by the blow and possibly removed. Two mandibular teeth (Fig. 15) bearing the signs of sharp force trauma were also recovered from the assemblage and are likely connected to this lesion. One of the teeth, a mandibular premolar from the right side, had been split by the trauma with the lesion, measuring 11.98 mm, starting from the middle of the occlusal surface and ending with a slant towards the lingual side approximately at the middle of the root, exposing the dentine and root cavity within the tooth before glancing off. The second tooth affected by the trauma is represented only by a root showing a lesion that is 7.65 mm long. This lesion is also most severe on the lingual side with two skip marks visible on top of the root near the cento-enamel junction and comes to a distinct stop in the middle of the root.

Figure 14. Sharp-force trauma to the maxilla. Photo: Jaana Ratas.

Figure 3. Sharp-force trauma to the mandibular teeth. Photo: Jaana Ratas.

The trauma to the T9 vertebrae (Fig. 17) is presented as a small cut mark under the right transverse process of the vertebrae with a length of 4.6.3 mm. It is one of the two postcranial weapon-related injuries from the Viidumäe assemblage. The cut is relatively short and shallow, possibly caused by the tip of a knife or an arrowhead.

Figure 4. Sharp-force trauma to the T9 vertebra. Photo: Jaana Ratas.

The second postcranial lesion can be found on the left anterior side of the right patella of a child (Fig. 18) aged 10 to 14 years. The cut is visible as a 10.02 mm long lesion, although it could have been longer as the left side of the patella has been affected by post-mortem taphonomic changes.

Figure 5. Sharp-force trauma to the patella. Photo: Jaana Ratas.

3.2 Case study 2 – The commingled remains from Lepna

The commingled remains of Lepna (Fig. 19) consists of 382 units of bones packaged in various sizes of find bags and numbered accordingly. Previously, both human and animal bones were mixed and labelled under one unit.

Only one long bone could be salvaged in the collection in its complete state. All other bones, except for some smaller irregular bones, are fragmented to a relatively higher degree than the bones from Viidumäe. Very few epiphyseal ends could be found in a state for accurate measurements. In addition to that, the periosteum of the bone fragments was oftentimes severely altered by taphonomic factors, including gnaw marks.

430 teeth were collected from the assemblage, including 35 still within the alveolar bone (17 in maxilla and 18 in mandible). 356 of the teeth belonged to adults and 74 (including 17 deciduous teeth) to non-adults. In most cases the teeth were damaged to some degree, including breaking, chipping of the enamel and loss of some or all parts of the root(s).

Figure 6. Human remains from Lepna. 1 = cranial fragments; 2 = attempt to reconstruct some long bones; 3 = taphonomic alteration to the bone. Photo: Maris Niinesalu.

3.2.1 Population profile

3.2.1.1 Minimum Number of Individuals (MNI)

42 pars petrosa were collected from the fragmented remains of Lepna (Table 11), with at least eight (n=8) of them belonging to non-adults. 19 of the pars petrosa, including 14 adult and five (n=5) non-adults, belonged to the right side, and 23, including 20 adult and three (n=3) non-adults, to the left side. Based on left pars petrosa it is assumable that at the minimum 23 people contributed to the assemblage. However, when divided to adults and non-adults, at least 25 people contributed to the assemblage including 20 adults and 5 non-adults.

Table 11. The pars petrosa from Lepna assemblage.

Find	**Square**	**Side**	**Age**
57	J17	L	Adult
85	Outside of parameters	R	Adult
114	M14	L	Adult
130	O14	R	Non-adult
135		L	Non-adult
138		R	Adult?
140		L	Adult
142		L	Adult
148		L	Non-adult
148		R	Adult

150	N8	R	Adult
189	N11	R	Adult
199	O13	R	Adult
202	M12	R	Non-Adult
217	N12	R	Non-Adult
234	O12	L	Adult
234	O12	R	Adult
235	O12	L	Non-Adult
247	P11	R	Adult
266	P12	L	Adult
266	P12	R	Adult
279	O15	R	Adult
281	N14	R	Adult
284	O14	R	Non-Adult
291	N12	L	Non-Adult
294	R11	L	Adult
294	R11	L	Adult
302	P11	R	Adult
304	N12	L	Adult
304	N12	R	Adult
321	N14	L	Adult
331	P10	L	Adult
338	O12	R	Adult
348	N11	L	Non-adult
349	O10	L	Adult
349	O10	R	Non-adult
349	O10	R	Adult?
354	O12	L	Non-adult?
354	O12	R	Adult
359	P13	L	Non-Adult
359	P13	L	Non-Adult

Additionally, MNI was calculated based on the number of adult molars (Fig. 20). The standard methods like ends of the long bones as well as other landmarks used for the derivation of MNI such as the axis and atlas were either poorly preserved, missing or severely fragmented, thus could not be used. The most frequently appearing tooth in the collection was the first maxillary left molar (14) which was represented by 30 elements. The right maxillary first molar (3), the right maxillary second molar (2), the left mandibular second molar (15), the right mandibular second molar (31), the left mandibular first molar (19) and the left mandibular second molar (18) represented relatively high numbers of elements (18, 14, 11, 15, 19 and 14, respectively) while the numbers of both the upper and lower third molars of both sides (1, 16, 17, 32) represented relatively low numbers.

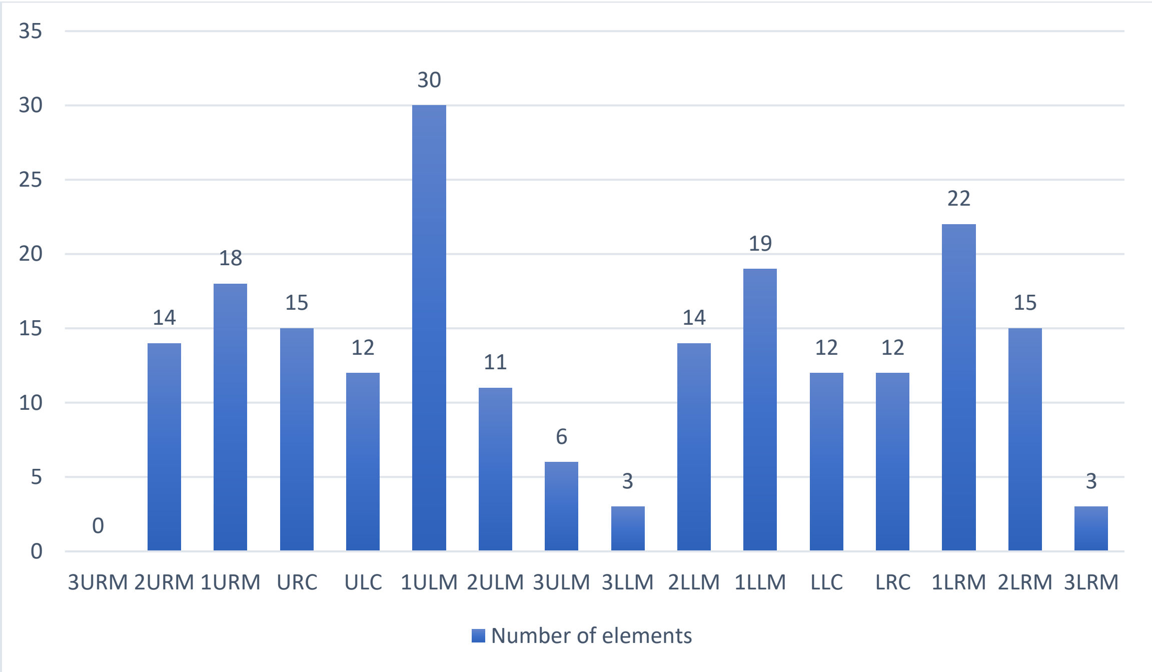

Figure 7. Estimating the MNI of Lepna from teeth.

These numbers, while somewhat matching with the MNI derived from the petrous part of the temporal bone, may not be the most accurate for the MNI contributing to the assemblage from Lepna as some of the teeth may have been lost ante-mortem or they may not have been survived. However, as the other elements used to calculate the standard MNI have largely been destroyed, the data derived from the number of molars be used as complementary information.

3.2.1.2 Sex Estimation

Ten (n=10) mastoid processes were studied to assign sex (Table 12). From these six (n=6) were from the right side and four (n=4) to the left. From the right mastoid processes, three (n=3) could be assigned to females, two (n=2) to males and one (n=1) could not be sexed. From the left mastoid processes, two (n=2) were of males, one (n=1) of a female and one (n=1) of the middle-ground and was not assigned to any sex. Thus, it may be concluded that at least three (n=3) females and two (n=2) males contributed to the assemblage of Lepna.

Table 12. Sex estimation from the mastoid processes from Lepna assemblage after Ascádi & Nemeskéri **(**1970)

Find		Side	Score	Assigned sex
150		R	1	F

239		R	3?	UD
281		R	4	M
302A		R	1	F
338		R	4	M
349		R	2	F
142		L	5	M
218		L	3	UD
290		L	5	M
294		L	2	F

Ten (n=10) fragments of the frontal bone were studied to assign sex from the prominence of the supraorbital margin. In five (n=5) cases the area of the glabella had also survived, allowing the joint study of both the supraorbital margin and the prominence of the glabella (Table 13). In five (n=5) cases only the right part of the frontal bone had survived, in four (n=4) cases only the left and in one (n=1) case both right and left parts of the bone had survived.

Out of the five (n=5) fragments from the right side, two (n=2) were graded as belonging to a male and two (n=2) as belonging to a probable male while one (n=1) result confirmed belonging to a middle-range and could not be assigned as belonging to either a male or a female. From the four (n=4) fragments from the left side, one (n=1) was graded as belonging to a male and one (n=1) as belonging to a probable male. Two (n=2) of the fragments resulted of belonging to the middle-range and were not assigned sex. The fragment with both the right and the left side present was graded as belonging to a male.

Table 13. Sex estimations from the supraorbital margins and the prominence of the glabellae from Lepna assemblage after Ascádi & Nemeskéri **(**1970)

Find	Side	Supraorbital margin	Prominence of the glabella	Sex estimation
202	R	3?		UD
265(2)	R	3	4	M?
265(2)	R	4?		M?

335A	R	4	5	M
340	R	4		M
136	RL	4	4	M
200	L	4	3	M?
201	L	3?		UD
213	L	5	4	M
292B	L	3?		UD

Only five (n=5) skeletal elements intact enough that at least some parts of them was measurable could be salvaged from the Lepna assemblage (Table 14). From those, only two (n=2) distal ends of tibiae were repetitive, but they were from different sides. The size difference between them, however, leads to a possibility that at least two (n=2) females contributed to the assemblage while from the humerus head diameter it is assumable that at least one (n=1) male contributed to the assemblage.

Table 14. Sex estimation from the measurements of skeletal elements from Lepna assemblage after Garmus & Jankauskas (1993), Garmus (1996) and Stewart (1979)

Find	Bone	Side	Measurement	Sex estimation
239	Calcaneus length	R	80 mm	F
290	Tibia distal width	R	36 mm	F
315	Fibula length	R	326 mm	F
355A	Humerus head diameter	R	59 mm	M
343	Tibia distal width	L	46 mm	F

3.2.1.3 Age-at-Death Estimation

The age-at-death estimation for adults in the Lepna derived from analysing the wear of permanent molars by Brothwell (1963) (Fig. 21). Out of 116 adult molars that could be sided for wear patterns analyse, 68 showed signs of very light wear and were placed in the age group of 17–25; 33 molars showed signs of moderate wear, placing them in the age group of 25–35;

13 teeth with advanced wear were placed in the age group of 35–45 , and only 7 of the molars showed signs of severe wear, indicating their placement in the age group of 45 +.

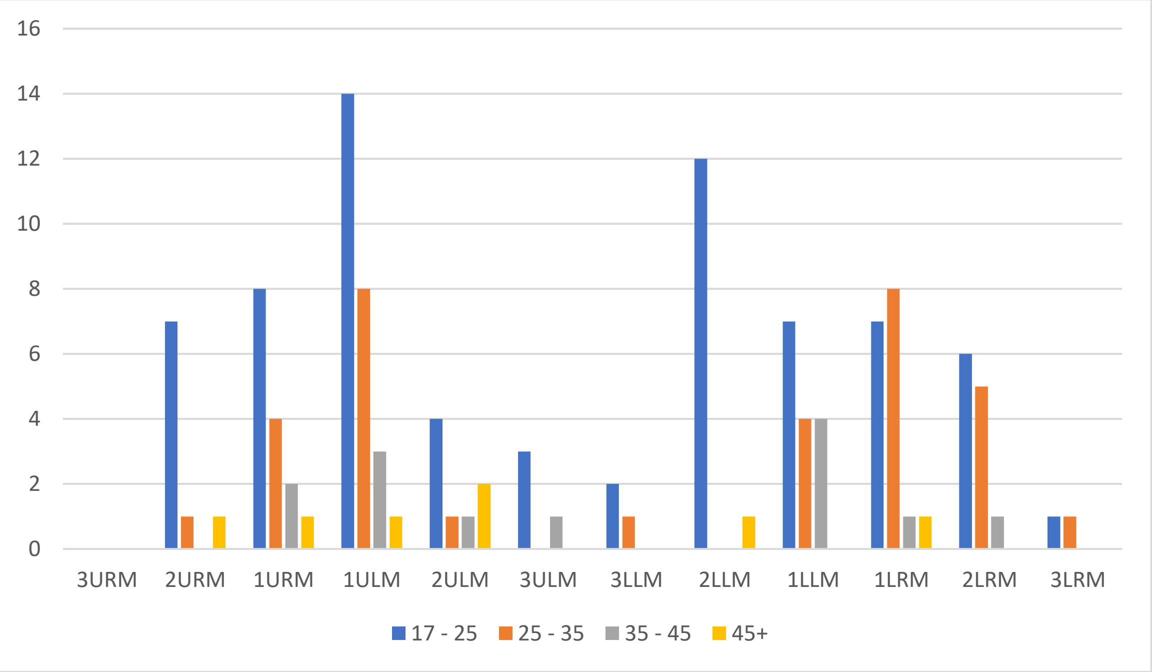

Figure 8. Estimating the number of people in age groups based on the wear of the molars from Lepna.

Thus, the minimum number of people belonging to a certain age group could be calculated. At least fourteen (n=14) adults aged 17–25 contributed to the assemblage as seen from the second left mandibular molar (2LLM). At least eight (n=8) adults aged 25–35 can be found based on the first right mandibular molar (1LRM) and at least four (n=4) adults in the age group 35–45 contributed to the assemblage as seen from the number of the first left mandibular molars (1LLM) that were placed in the age group. Only two (n=2) adults in the advanced age group of 45 + could be found based on the teeth as seen from the second left maxillary molars (2ULM).

Altogether, seventy-three (n=73) teeth belonging to non-adults were identified from the Lepna assemblage (Table 16), with sixty-seven (n=67) of them successfully sided and their age assessed. Nine (n=9) of the teeth were deciduous, while the other sixty-four (n=64) were either erupting or recently erupted.

The teeth most represented in the permanent dentition were the second right maxillary molar (2URM), the first right maxillary molar (1URM), the first left maxillary molar (1ULM), the first left mandibular molar (1LLM) and the first right mandibular molar (1LRM). Based on this, it can be assumed that a minimum number of three (n=3) children aged between 2 – 4 and at least one (n=1) child from the age ranges 3–5, 3.5–6.5, 4–8, 5–9, 6–10, 7–11 and 9.5–14.5 are present in the assemblage of Lepna. From the first right mandibular deciduous molar (S) it is assumable that at least three (n=3) children from age ranges 2–4, 3–5 and 4–8 are present in the assemblage. From the first left mandibular deciduous molar (L) two (n=2) children aged 5–9 and 7–11 can be found.

Table 16. Non-adult dentition and age assessments from Lepna assemblage after Ubelaker (1989)

Find	Square	Tooth	No	Age	Range
NI		2LRM	31	7±24k	5 – 9
58	K16	2URI	7	4±12k	3 – 5
58	K16	2UPM		5±16k	3.5 – 6.5
58	K16	1URdM	B	8±24k	6 – 10
120	R16	1URM	3	5±16k	3.5 – 6.5
145		1ULI	9	6±24k	4 – 8
145		1ULI	9	6±24k	4 – 8
158	N13	1ULM	14	9±24k	7 – 11
172	N13	1LRM	30	3±12k	2 – 4
172	N13	1ULM	14	3±12k	2 – 4
185	M12	Molar		7±24k	5 – 9
187		1URPM	5	6±24k	4 – 8
189	N11	3LRM	32	11±30k	8.5 – 13.5
200	N12	URC	6	7±24k	5 – 9
200	N12	2URM	2	12±39k	9.5 – 14.5
202	M12	3ULM	16	15±26k	13 – 17
217	N12	1LLI	24	5±16k	3.5 – 6.5
217	N12	1LLPM	21		
217	N12	LLC	22	5±16k	3.5 – 6.5
218	M13	LRC	27	11±30k	8.5 – 13.5
234	O12	2URM	2	8±24k	6 – 10
238	N11	1LLM	19	5±16k	3.5 – 6.5
238	N11	2ULI	10	4±12k	3 – 5
238	N11	ULC	11	5±16k	3.5 – 6.5
248	P11	1ULM	14	5±16k	3.5 – 6.5
248	P11	1LLI	24	7±24k	5 – 9
258	O12	2ULI	10	6±24k	4 – 8
258	O12	1LRdM	S	3±12k	2 – 4
258	O12	1LRdM	S	4±12k	3 – 5
264	O13	Molar		11±30k	8.5 – 13.5
265	P12	1URPM	12	12±30k	9.5 – 14.5
265	P12	1LLM	19	-17	
272	R10	2LLM	18	-17	

283		1LLM	19	6±24k	4 – 8
287	P12	2URM	2	6±24k	4 – 8
290	N11	2URM	2	-17	
304	N12	1LRdM	S	6±24k	4 – 8
306	N13	2LRM	31	6±24k	4 – 8
306	N13	2ULM	15	7±24k	5 – 9
308	P12	2URI	7	8±24k	6 – 10
308	P12	1LLPM	21	5±16k	3.5 – 6.5
308	P12	1URM	3	3±12k	2 – 4
308	P12	1LRM	30	3±12k	2 – 4
308	P12	1ULM	14	7±24k	5 – 9
309	O12	1URM	3	4±12k	3 – 5
316	O11	1ULdM	I	6±24k	4 – 8
317	N13	1LRM	30	7±24k	5 – 9
318	N12	2URI	7	8±24k	6 – 10
319	O12	1URM	3	9±24k	7 – 11
333	R11	3LLM	17	12±30k	9.5 – 14.5
336	P11	1LLPM	21	10±30k	7.5 – 12.5
336	P11	2LRPM	29	6±24k	4 – 8
337	O11	2LRPM	29	12+	
349	O11	2LRM	31	8±24k	6 – 10
349	O11	1URPM	5	5±16k	3.5 – 6.5
351	P12	Premolar		5±16k	3.5 – 6.5
351	P12	Premolar		5±16k	3.5 – 6.5
351	P12	1ULdM	I	8±24k	6 – 10
353	M14	1LLdM	L	7±24k	5 – 9
353	M14	2LLI	23	7±24k	5 – 9
353	M14	2LRI	26	7±24k	5 – 9
353	M14	LLC	22	7±24k	5 – 9
353	M14	1LLPM	21	7±24k	5 – 9
353	M14	2LRdM	T	7±24k	5 – 9
353	M14	2LRPM	29	7±24k	5 – 9
353	M14	LRC	27	7±24k	5 – 9
354	O12	1LLdM	L	9±24k	7 – 11
354	O12	1LLM	19	9±24k	7 – 11
354	O12	2ULPM	13	5±16k	3.5 – 6.5
358	P13	1LRM	30	3±12k	2 – 4
358	P13	1LLM	19	3±12k	2 – 4
358	P13	2LLM	18	6±24k	4 – 8
362	P13	2LLM	18	7±24k	5 – 9

3.2.1.4 Cremated bones

Altogether 55 fragments of burned bone were found from Lepna (Table 17). As the remains were highly fragmented, only some bones could be assigned with certainty, whilst most were assigned to be either fragments of long bones or cranium. Out of the 55 pieces of burned bone, thirty-one (n=31) were categorized as a fragment of a long bone and ten (n=10) as being a fragment of the cranium. Four (n=4) fragments of burned bone that could possibly be from the cranium were also detected along with a hamatum, a proximal phalanx, three (n=3) fragments of ribs and a fragment from a vertebra. The overall weight of the burned bones was 50.3 grams.

The fragments showed a variety of colours that could be found in cremated human remains, varying from black-brown and off-white to pure white, grey, and blue tones. However, it is common for a wide range of colour alterations to be found within a single skeleton or even on a single bone, especially in cases where remains that still have flesh intact have been burned (Ubelaker 2008, 3).

As the epiphyseal ends of the proximal phalanx have closed completely, it is assumable that at least some of the cremains belong to an adult as the epiphyseal ends of the proximal phalanges close between ages of 13–19 (Flecker 1942).

Table 17. Burned bones from Lepna assemblage.

Find	Sq.	Colour	Cracking	Bone	Lngth.	Wdth.	Thck.	Wght.
77	L10	Black/brown		Hamatum	23.55	17.12		1.2
77	L10	Black/brown		?	22.79	13.6		0.8
77	L10	Black/brown		Cranium	12.51	11.9		0.4
146		Black/brown		Cranium	45.7	30.28	4.71	5.5
155	N13	White		Cranium	22.73	28.1	3.23	1.8
155	N13	White		Cranium	10.81	9.77		0.4
155	N13	White		?	10.7	6.97		0.2
172	N13	White		Long bone	26.37	19.06		1.5
172	N13	White		Long bone	23.24	9.95		0.4
172	N13	White	Present	Long bone	17.99	7.04		0.4
172	N13	Off-white		Long bone	12.84	13.53		0.4
183	L16	White	Present	Proximal phalanx	33.46	9.26	6.26	1.5
183	L16	White		Long bone	31.45	12.87		1.3

183	L16	Off-white		Cranium	34.23	35.86	5.77	3.5
183	L16	White	Present	Cranium	25	14.39	4.68	0.9
183	L16	White		Long bone	18.92	10.25		0.2
183	L16	White		Cranium	25.72	15.63		0.7
183	L16	White		Long bone	27.62	6.91		0.2
183	L16	White		Long bone	26.87	8.75		0.2
183	L16	White		Long bone	13.39	9.16		0.1
183	L16	Off-white		Cranium?	14	11.7		0.8
183	L16	White		Cranium?	10.7	11.81		0.1
183	L16	White		Cranium?	13.2	9.02		0.1
183	L16	White		Long bone	10.47	4		0.1
183	L16	White		Long bone	10.62	4.74		0.1
183	L16	White		Long bone	8.37	3.61		0.1
183	L16	White		?	7.15	4.8		0.1
197	K11	White		Long bone	21.96	6.7		0.5
197	K11	White		Long bone	20.23	9.29		0.8
197	K11	White		Long bone	13.09	10.38		0.5
197	K11	White		Long bone	13.5	7.85		0.3
200	N12	White	Present	Long bone	27.7	9.08		1.7
265	P12	White		Long bone	19.7	5.54		0.3
265	P12	White	Present	Cranium	16.12	14.1	1.96	0.4
281	N14	White	Present	Long bone	28.22	8.55		0.7
283		White	Present	Rib	21.24	8.52		0.6
291	N12	White	Present	Long bone	23.37	12.89		1.3
292	M13	Grey	Present	Cranium?	20.96	17.15		1.1
306	N13	White	Present	Long bone	19.77	10.99		1.1
309	O12	White	Present	Long bone	17.76	5.67		0.3
312	R11	White	Present	Long bone	30.75	5.88		0.7
320	P13	White	Present	Long bone	27.05	9.71		1.6
328	O11	White	Present	Long bone	19.66	14.52		1.1
336	P11	White	Present	Long bone	23.98	6.93		0.5
336	P11	Grey		Vertebra	14.81	12.86	7.89	0.6
337	O11	White		Long bone	25.13	7.72		0.4
337	O11	White		Cranium	23.38	13.06	4.69	1.2
338	O12:	Brown/white/blue	Present	?	14.07	17.82		0.8

338	O12	White		Long bone	14.47	8.09		0.8
339	P12	White/blue/grey	Present	Rib	15.15	16.2		0.6
342	O13	White	Present	Long bone	18.85	9.36		0.9
343	M13	White	Present	Rib	52.93	18.87		4.1
350	S10	White	Present	Cranium	27.36	12.73		1.6
351	P12	White	Present	Long bone	21.55	8.88		0.7
362	P13	White	Present	Long bone	31.3	13		2.1
							Total weight:	50.3

3.2.1.5 Trauma

Only one (n=1) sharp force trauma was found from the assemblage from Lepna (Fig. 22). This lesion, measuring 37.75 mm in length was delivered to the right parietal bone. The lesion did not penetrate the bone, but instead coming to a stop at the inner periosteal layer of the cranial bone.

Figure 9. Sharp-force trauma to the parietal bone. Photo: Jaana Ratas.

4.Discussion

4.1 Population profiles of Viidumäe and Lepna graves

One of the main objectives of this master´s thesis was to learn more about the population profiles of both Viidumäe and Lepna assemblages through bioarchaeological perspective. While some research has been already done on this issue, by Raili Allmäe (Viidumäe) and Jonathan Kalman (Lepna), the results gained from my analysis on the remains have given some more insight to whom and how many of them could be found in both assemblages.

4.1.1 Population profile of Viidumäe

The first problem encountered during the research on the remains from Viidumäe was how many people exactly contribute to the assemblage. From Raili Allmäe´s preliminary research it was clear that the assemblage contained the remains of at least ten people, five of them likely male, two of them likely female and three non-adults (Mägi et al. 2015). It is not stated, however, which elements of the bones were used to derive the minimum number of individuals.

During the research as many elements as possible were used to see if there would be any differences in the resulting MNI. While the values of the proximal end of the femur, distal end of the humerus and pars petrosa all gave the value of MNI as 9, it didn´t take into count the different number of adults and non-adults present in the assemblage. As 8 adult left tali and 4 right and left proximal ends of femora were found from the assemblage, the MNI grew to be at least 12. However, while looking further into the issue a size difference between the femora was noticed, where one of the non-adult proximal parts of the femora seemed to be substantially smaller than the rest. Measurements taken from the width of the femoral neck showed that the femora could not, in fact, be paired and the assemblage contains the remains of at least five non-adults, growing the MNI from 12 to 13.

The age of the people contributing to the assemblage was determined mainly based on dentition as the remains were too damaged and fragmented for the other methods to be of significant use.

The dental wear of the adults from the Viidumäe assemblage shows that based on the second maxillary left molar (15), the first mandibular right molar (30) and the second mandibular right molar (31) at least 8 of the adults could be identified as belonging to the age group of 17 – 25. Based on the first mandibular left molar (19), the third mandibular left molar (17) and the third mandibular right molar (32), at least three adults could be placed in the age group of 25 – 35 and, that one first mandibular left molar (19) showed signs of advanced wear which would indicate an age between 35 – 45. This, however, would mean that based on the assessment of single teeth as an indicator of age would cause a rise in the MNI as the number of adults by age groups would be 12.

The teeth of the non-adults also yielded conflicting results. Based on the first mandibular deciduous molar (S), at least two children aged between 6 – 10 contributed to the assemblage. From the first mandibular right molar (30) at least two of the non-adults had reached an age between 4 – 8 and from the second mandibular right molar (31) at least two had reached and age between 5 – 9. The results gained by studying the eruption of the teeth from the non-adults of Viidumäe showed that all the non-adults had reached an age between 4 – 10, placing them mainly in the age group of *Infans II*.

As the remains from Viidumäe were somewhat better preserved than the remains from Lepna it allowed for a metric approach when assessing the sex of the individuals from Viidumäe. Even though measurements were taken from multiple elements such as the calcaneus, talus, femoral head, and the distal width of the humerus, the best results were gained from the bicondylar width of the femorae and the distal width of the tibiae. The first showed a result of at least three males contributing to the assemblage and the second of at least three females contributing to the assemblage.

The research also yielded three additional sharp force traumas, one of which may be complementary to the trauma to the alveolar bone of the maxilla previously noticed by Raili Allmäe. The first was a lesion to a T9 vertebra possibly caused by the tip of a knife or an arrowhead. This shows that at least three types of sharp-force trauma could be found on the remains from Viidumäe – slashing, chopping, and stabbing. The second trauma was found on the patella of a non-adult, which shows that compared to the other traumas that were dominantly found on adults, non-adults, too, were subjected to violence. The third, complimentary trauma was found from two mandibular teeth, possibly showing a stopping point of a blade.

4.1.2 Population profile of Lepna

As the remains from Lepna were considerably more fragmented, the MNI was calculated from the pars petrosa as well as from the teeth. The pars petrosa gave a result of an MNI of 25 people including 20 adults and 5 non-adults. Unfortunately, the pars petrosa were too damaged to be successfully paired, which would have aided in the calculation of the MLNI. Amongst the teeth, 30 first maxillary left molars could be found, 25 of which belonged to adults, 4 to non-adults and 1 that could not be adequately assessed.

In addition to the MNI gained from the standard method, 50.3 grams of cremated human remains could be found from the Lepna assemblage. The cremains belong to at least one adult as could be seen from a proximal carpal phalanx. Even though the addition of cremains is invisible by standard MNI, including it to the assemblage would raise the number of people contributing to the assemblage by 1.

These results greatly differ from those obtained by Jonathan Kalman. While Kalman identified only four adults by the petrous part of the temporal bone, the results gained during this research indicated the presence of at least 20 adults by the pars petrosa alone. However, while Kalman also identified the remains of at least three infants and a 2 – 3-year-old from a femur, he did not further discuss which elements the infants were identified from nor the find number of the non-adult femur. This unfortunately means that there is little chance to further analyse these claims.

Due to the highly fragmentary state of the remains, the possible sex of the remains was assessed mainly based on sexually dimorphic traits of the mastoid process, the supraorbital margins, and the glabellae. The mastoid processes indicated the presence of at least three females and two males while the combination of the scores from the supraorbital margins and the glabellae indicated the presence of at least four males and three possible males (with three left undetermined). Measurements were also taken from available long bones and tarsal bones, which yielded the presence of at least two females and one male.

As with the remains from Viidumäe, the age of adults was assessed by the wear of mandibular teeth. By the results, at least 14 people could be placed in the age group of 17 – 25, 8 people in the age group of 25 – 35, four people in the age group of 35 – 45 and two people in the age group of 45+. This, however, would indicate the presence of at least 28 adults between the ages 17 – 45+.

The ages of non-adults were assessed by the eruption of the teeth as well as the epiphyseal closure. By the eruption of the teeth, 8 age groups could be found: 2 – 4, 3 – 5, 3.5 – 6.5, 4 – 8, 5 – 9, 6 – 10, 7 – 11 and 9.5 – 14.5, with at least three individuals within the age range of 2 – 4.

Only one sharp force trauma to the right parietal bone could be detected from the assemblage from Lepna.

4.1.3 Conclusions drawn from the population profiles of Viidumäe and Lepna assemblages

While both assemblages from Viidumäe and Lepna were fragmented and commingled to a degree where no remains of one individual could be salvaged, there are many notable differences between the two depositions.

The remains from Viidumäe were found tightly packed together from a relatively small ditch, indicating that the remains were buried after considerable decay had already taken place while the remains from Lepna had been found scattered in a larger construction, interpreted as a mortuary house. Another significant difference can be noticed between the items found *with* the human bones from Lepna, interpreted as grave goods compared to the items found *around* the remains from Viidumäe that have been interpreted as votive offerings. The grave from Lepna also included a large amount of animal bones both from domesticated animals as well as wild animals and rodents together with numerous pieces of pottery while only one mandible from a large animal was found from Viidumäe in 2016.

From these differences it can be hypothised that the complex of Lepna was intended *for the dead* e.g. the items and offerings were meant to go for or with the people who´s remains were placed there while the human remains and items found from Viidumäe were meant *for the complex*. It is impossible to confirm by the human remains whether or not the idea of human sacrifice hypothised by Marika Mägi (Mägi et al. 2014, 95) is true or not but, combined with the violent trauma found on the remains (including non-adults) as well as the relatively concentrated age groups, it is possible that the people who´s remains were found from Viidumäe died during a one-time traumatic event.

On the other hand, the remains from Lepna show a wider range of age groups including *Infans I* (0 – 6), *Infans II* (6 – 13), *Juvenilis* (13 – 20), *Adultus I* (20 – 30), *Adultus II* (30 – 40) and *Maturus I* (40 – 50). This, including the fact that only one case of violent trauma was found from the assemblage of Lepna, indicates that the burial site could have been used by one community for generations. This is also supported by the discovery of cremated remains which means that during the time the burial place was in use, the burial customs themselves had gone through a change of idea.

4.2 The complications of standardised methods when applied to fragmented and commingled human remains

The second objective of this master´s thesis was to observe how the chosen standard methods used to assess the MNI, sex and age-at-death behaved when applied to severely fragmented commingled remains and to describe the possible issues that may arise from it. The greatest issue with the standardised methods used in determining the MNI in an assemblage as well as their biological profile (e.g., sex and age) in both adults and non-adults is that they are designed to be used in conjunction to each other. To get the greatest possible outcome of these standardised methods and the most accurate estimate of a person´s age or sex from their skeleton, most researchers use multiple methods on multiple body parts. For example, in a study published in 1999 by Baccino et al., seven methods of determining age-at-death (dental Lamedin method (1992), the Suchey-Brooks method of assessing the pubic symphysis (1990), Iscan method relating to the sternal rib ends (1984), the Kerley histological method (1965), as well as three combined methods) were put to test on a single French collection of individuals of known age and death in a blind study. As a result, all the combined methods outperformed the individual techniques (Ubelaker and Haley 2019, 2).

4.2.1 MNI

In this study, the traditional approach to calculating the MNI was used as the remains were too fragmentary and taphonomically compromised for them to be reliably sorted in according to zones or landmarks. An attempt was made to, in the case of Viidumäe, to use both the proximal and distal ends of the long bones as well as the petrous part of the temporal bone. In the case of Lepna, however, the long bones were too damaged to be of any use in calculating the MNI.

As stated before, the calculation of the standard MNI is very much straightforward - the chosen skeletal elements are collected, divided into left and right and counted with the highest number used to represent the minimum number of individuals contributing to the assemblage (Lambacher et al., 2016, 3). This method, however, has its downfalls especially in the case where the bodies have gone through secondary burial; when some of the bodies have gone through differential treatment than the others (e.g., cremation); or when the remains have been exposed to taphonomic factors that can result in some of the skeletal elements being destroyed (e.g. animal scavenging, acidic soil).

Yet another issue is that the standard MNI does not take into count the metric or morphological attributes of the bone. Such an instance was encountered when analysing the assemblage from Viidumäe wherein 8 proximal ends of femora belonging to non-adults were found, with 4 assigned to the right side and 4 to the left side. By standard MNI this would mean that there are at least 4 non-adults contributing to the assemblage. However, on further study, it became apparent that while 4 sets of proximal ends of the femora could be successfully paired, one of the proximal ends was metrically smaller and not a match to the remaining femur. Due to the difference in size, it became apparent that these 8 proximal ends of femora represented 5 individuals instead of the 4 that was gained from standard MNI.

The most reliable element for calculating the MNI turned out to be the petrous part of the temporal bone. The main reason for this is that the petrous part of the temporal bone has a compact structure, making the skeletal element resistant to destructive factors such as mechanical pressure or high temperature (Kozerska et al. 2015, 34). The petrous part of the temporal bone is also easily recognizable and sideable, making the process of sorting and calculating the MNI fast and easy.

The difficulty in using the petrous part of the temporal bone to determine the MNI is that if one or more parts of the skeletal element have been destroyed or disfigured, pairing them becomes complicated, eliminating the possibility of accurately calculating the MLNI. Another issue is that it is difficult to distinguish between the petrous parts of the temporal bones of adults and non-adults reaching adolescence (Schaefer et al 2009, 18).

In the case of cremated remains from Lepna, no petrous parts of the temporal bone or teeth were found. This, however, made the cremated remains invisible in the standard MNI calculated from other remains.

As a result of this research it can be said that when dealing with highly fragmentary commingled remains e.g. those from Lepna, it would be wise to use a skeletal element that is known for its high survival rates such as the petrous part of the temporal bone and pair it with another element that would allow for more thorough age-at-death assessment such as the teeth. In remains like those from Viidumäe it would also be advisable to pay attention to the possible metric differences of the skeletal elements and, if possible, to choose multiple elements for the calculation of the standard MNI.

4.2.2 Sex estimation

Fragmentation also played a large role in assessing the biological sex of adults as the hip bones, which are the most reliable in sex estimation, were too damaged to be reconstructed in both assemblages. In the case of Viidumäe, the sex estimation was derived based on the measurements of long bones and tarsal bones (calcaneus and talus) as they were better preserved than the sexually dimorphic elements of the skull. In the case of Lepna, however, the long bones were too fragmented to be successfully reconstructed so the main assessment of sex came from the macroscopic analysis of the mastoid process, the supraorbital margins, and the prominence of the glabella.

4.2.2.1 Sex estimation by the sexually dimorphic traits of the skull

It is especially complex to derive an assessment of sex from the morphological features of the skeleton because the sex-related differences between males and females are only tertiary. The morphological features also largely overlap between the sexes, which means that no clear assessment can be made in the middle of the overall range (Rösing et al. 2007, 78). The methods based on the morphology of skeletal elements are also very descriptive and rely strongly on the interpretations made by the researcher (Sierp & Henneberg 2015, 1).

The maximum number of females that were managed to identify in the Lepna sample during this research came to be three while the maximum number of males came to be four (seven, when including possible males). This means that compared to the MNI of adults totalling 25 individuals, sex estimation from dimorphic traits of the skull yielded only a 28% (40%) result.

In a study using 20 skeletons (19 of them of unknown sex to the researcher), only 9 individuals showed a consistent result of sex estimation by all 7 morphological methods used (Sierp & Henneberg 2015: 3). However, there is some viability of accidental bias by the researchers as the skeletons used in the study were not fragmented or commingled, meaning that there was a possibility of cross-referencing.

It would be ideal to use DNA testing on commingled and fragmented remains in order to get a more in-depth analysis of the biological sex of a population, but that possibility is not always available for researchers. While the results of this study using the morphologic traits of the skull certainly gave some insight into the demography of the people who´s remains were found from Lepna, they should be treated as the minimum number of males and minimum number of females from this sample.

4.2.2.2 Sex estimation by the measurements of long bones and tarsal bones

The mankind exhibits a considerable amount of temporal and geographic variation in the size and shape of their bodies. This can be viewed on a global level in which the geographic variations in body size and shape is caused largely due to genetic differences acquired through the long-term processes of natural selection and produce adaption to different environments. Within the smaller general regions (e.g. Europe), body size and shape can differ between generations as well as neighbouring populations, reflecting differences in other values such as general nutritional status, health, and physical activity (Ruff 2017, 49).

Nevertheless, metric measurements are one of the traditional methods used for estimating sex from the long bones with the humeral head, the humeral length, the femoral head and the femoral length favoured by researchers. However, the methods have been developed on a wide variety of skeletal remains including dry bones (Dorsey 1899) and bones obtained during the postmortem process (Dwight 1905) as well as from the skeletal elements from the right side (1905), the left side (Thieme & Schull 1957) and both sides (Pons 1955; Trancho et al. 1997) (Harrison 2019, ch.2).

The differences in stature and body shape can also vary not only between geographic areas but also between centuries and even decades. Male stature especially exhibits phenotypic plasticity which means that non-genetic factors such as health and nutrition may have a considerable influence. According to one study (de Beer 2004), the average height of young adult Dutch males has increased from 178.0 cm to 184.0 cm and the average height of young adult Dutch females from 166.3 cm to 170.6 cm while the total increase in stature since the 19th century has been approximately 17 cm among males and approximately 13 cm among females. Overall, the sexual dimorphism in body height is expected to increase and decrease as the mean stature does (Ruff 2017, 50).

It should also be kept in mind that sexually dimorphic traits and the idea of the robustness of the male skeleton and the gracility of the female skeleton as well as the idea that males tend to be generally larger than females (in stature) is not set in stone and that normal biological variation does exist even in smaller populations (White et al. 2005, 386). For example, during the study of the Luis Lopez Skeletal Collection housed in the University of Lisbon, the cranium and mandible of a 49-year-old male scored neutral while the superciliary arches and the orbit scored male. The pelvic features, however, as well as the humerus and femur scored as female, with the measurement of the humerus being 295 mm compared to the mean of 305 mm and the femoral length being 410 mm compared to the mean of 426 mm (Harrison 2019, ch.10).

Most of the skeletal measurements taken from the Viidumäe assemblage were compared to the data provided by Garmus & Jankauskas (1993) and Garmus (1996) which are the closest parallels to the materials from Estonia as they have been developed on the Lithuanian population. However, due to the fragmentation and commingling of the remains the results can only be presented as the minimum number of males and the minimum number of females. It would be optimal to have the use of methodology developed on the population under research. This means, that it would be highly suggested for the Estonian anthropologists and osteologists to compile their own standards.

4.2.3 Age-at-Death estimation

As a rule, to gain the most accurate age-at-death estimate from the skeletal remains, a researcher would use all the means available and compare the outcomes. In doing this, the most well-known morphological methods would usually be used, such as Brothwell´s chart on tooth wear, Suchey-Brooks method of deriving age from the pubic symphysis and Meindl and Lovejoy´s method of deriving age from the sutures of the skull. The results would be then added, and a general mean would be calculated.

4.2.3.1 Adult age-at-death estimation by the wear of the molars

The most widely used method of assigning age to a set of adult remains is the Brothwell System for Scoring Surface Wear in Molars (1981). The chart is designed to assist in assigning the age-at-death to a set of remains based on the exposure patterns of dentine in the M1, M2 and M3 molars and placing the results into four age categories: 17-25, 25-35, 35-45 and 45+. Brothwell used the material from many British archaeological investigations from the Neolithic time (4000 BC) up to the late middle ages (16th century) to help develop the chart for estimating tooth wear and age at death for these populations (Richter & Eliasson 2015, 5).

The amount of wear on the first molar is indicative of 6 years of wear by the time the second molar erupts, meaning, that when the third molar erupts, the first molar has had 12 years of wear and the second molar 6 years. The exposure and wear of the molars should be, therefore, based on their eruption time and, in turn, a basis for age estimation (Richter & Eliasson 2015, 4).

Tooth wear patterns, however, are not solely formed by a function of age, but are also significantly influenced by many other factors such as the person´s diet (roughness of the food), their method of mastication, existence of artificial teeth, geographic location, gender, environmental conditions and parafunction (Alayan et al. 2018, 56).

Brothwell´s method has been tested many times. A study in Iceland by Svend Richter and Sigfus Thor Eliasson (2015), investigated the extensive tooth wear found in ancient populations in relation to diet. The research concentrated on the 66 remains found from the ancient graveyard at the Skeljastadir farm in Thjosardalur, Iceland, with 23 skulls assigned the age of 18 and above from different methods, tested for tooth wear with Brothwell´s method (Richter & Eliasson 2015, 1-3).

The study concluded that the extensive wear to the molars of the people from Skeljastadir graveyard could be due to the food ancient Icelandic people consumed. Owing to a lack of salt, coarse foods such as air-dried fish and meat were one of the main foods eaten by ancient Icelanders. In addition, dried foodstuffs contaminated by volcanic ash as well as acidic dairy products such as mysa, syra and skyr, could have contributed to the extensive tooth wear (*ibid*., 6 - 7).

In the studies, however, two or more molars were used in sequence as they were preserved in mandible. In the case of Viidumäe and Lepna, little teeth had been preserved in the alveolar bone (in Viidumäe more than in Lepna), which meant that the teeth were often separate and commingled. Therefore, there was no way to check the assessment of age at death derived from the Brothwell chart with other methods or even with the teeth that should have been in the line next to each other.

An interesting case was found from Viidumäe (Fig. 23), where two pieces of the same male mandible were recovered from different locations, having been broken and commingled before the burial. Both sides of the mandible retained all three of the lower molars, which made it possible to assign the age at death using the Brothwell chart. While studying the mandible, however, it turned out that while all three molars on the right side were indicative of an age between 25 - 35, only two molars of the left side could be placed in the same age group, with the third molar, M1, showing a wear pattern indicative of the age group of 35 - 45.

Figure 23. A mandible from Viidumäe showing different wear of molars.

This shows that the difference in the levels of tooth wear can also be found in one person and might be due to the use of teeth while working or a different style of mastication or diet that resulted in some of the teeth wearing down faster than the others (Alt & Pichler 1995, 268).

Another example of irregular tooth wear comes from Lepna (Fig. 24). There one half of a mandible recovered from M12 where the M1 and especially the M2 have been worn down on the edges of the occlusal surface rather than the middle making it rather difficult to accurately estimate the age of death of this individual. It is quite possible that the wear is due to the person having used teeth while performing some type of work, resulting in a tooth wear that deviates from the norm.

Figure 24. A mandible from Lepna showing unusual wearing on the molar.

4.2.3.2 Non-adult age-at-death estimation by the eruption of teeth

The development and eruption of teeth is useful when assessing maturity and age-at-death in palaeoanthropology, bioarchaeology as well as forensic odontology as they are very mineralized and therefore less likely to be affected by environmental and nutritional disturbances (AlQahtani et al. 2014, 1) Teeth are also more likely to withstand taphonomic interference during the process of decay and skeletonization, being usually found in relatively well-preserved condition (White et al. 2005, 127).

However, while teeth develop in a relatively predictable order to each other, the accuracy and error of estimating the age-at-death from dental development charts such as the Schour and Massler atlas (1941a, 1941b) and Ubelaker´s dental chart (1989) is rather sparse and the variations between populations in regards to the timing of tooth formation is not well understood. (AlQahtani et al. 2014, 2) While some research has been performed on the topic the understanding of applicability of Ubelaker´s dental chart (1989) to modern populations is limited (Adams et al. 2018, 191-192). From there it wouldn´t be unreasonable to assume the same possible limitations regarding historic populations.

The greatest issue when analysing the non-adult dentition from both Viidumäe and Lepna assemblage was that they were seldom found with the alveolar bone still intact. This means that very little teeth could be studied in sequence or the level of their eruption could be adequately assessed. Another issue was with the taphonomic damage to loosen teeth which meant that some of the teeth were either too broken or their developing roots too damaged in order to give more than a tentative assumption of the age-at-death.

Based on loose teeth alone, with no other reliable methods for cross-referencing, it was difficult to figure out just how many non-adults belonged in a certain age category, meaning that only the minimum number of non-adults possibly within in the age-range could be given. The ranges themselves do overlap quite a bit but the presence of recurrent elements did allow to specify the number of non-adults in some age ranges. Still, the results gained from using the Ubelaker chart on loose commingled teeth should be regarded as the possible minimum, especially if no complete sets of remains can be restored.

However, on remains such as those from Viidumäe and Lepna, assessing age-at-death based on the development and eruption of teeth may be the only somewhat reliable method that could be used. In both cases the symphyseal surfaces were often rendered unusable for age assessment as they were completely or partly destroyed, and the material needed to allow adequate size comparison between fragmented elements was unavailable. Overall, it would be best for the Ubelaker chart to be used amongst other age assessment methods if feasible, but it is possible say that the chart also performs relatively well by itself when used on fragmentary and commingled remains.

5. Conclusions

This MA dissertation analysed two assemblages containing commingled and fragmented human remains from Saaremaa, Estonia – a 7th – 9th century interment from Viidumäe that has been interpreted as a sacrificial site and a 6th – 7th century mortuary house from Lepna. The main focus was to give a more detailed overview of the population profiles of both graves using a bioarchaeological perspective in order to assess the minimum number of individuals as well as the ranges of ages and sex. The second objective was to learn and analyse the way the chosen standard methods interact with commingled and highly fragmented remains.

The results of this study show that assemblage from Viidumäe contains the remains of at least 13 people, 8 of them adults and 5 non-adults. This result was gained by choosing multiple skeletal elements in order to comply a thorough analysis of the standard MNI. Based on the measurements of long bones and tarsal bones, at least three males and three females contributed to the assemblage. Based on dental wear, at least 8 adults could be placed in the age category of 17 – 25 and least 3 in the age category of 25 – 35. One molar also showed signs of advanced wear, placing it into the age category of 35 – 45. These results, however, should be treated with caution as the sample from Viidumäe showed signs of either preferential chewing or using teeth as part of the working process. Based on the developing dentition, at least two non-adults from the Viidumäe assemblage could be placed in the age category of 4 – 8 years of age and at least two in the age category of 5 – 9. In any case, all of the non-adults from Viidumäe sample were between 4 – 10 years of age. Three additional lesions caused by sharp force trauma were also discovered from the assemblage from Viidumäe, two of them post-cranial and one of them to the mandibular teeth.

The results from the population profile of Lepna show that the remains of at least 26 adults and 5 non-adults had been deposited there. From them, the presence of at least three females and two males could be identified by the morphological elements of the skull and the measurements of long bones. This number, however, remains low due to the high fragmentation of the remains. Based on dental wear, at least 14 adults could be placed in the age category of 17 – 25, at least 8 adults in the age category of 25 – 35, at least four adults in the age category of 35 – 45 and two adults in the age category of 45+. As with Viidumäe, however, some of the teeth showed signs of possible preferential chewing or using the teeth as a tool. From the developing dentition it can be said that at least three non-adults could be placed in the age range of 2 – 4, and that the dentition showed the presence of age ranges from 2 to 14.5. In addition to adding to the results given by Kalman in 2002, two new discoveries were made – the presence of cremated remains of an adult as well as the only sharp force trauma found from the Lepna assemblage thus far, a cut to the right parietal bone.

This research on commingled and fragmented remains also highlighted multiple downfalls of the methods commonly used on articulated skeletons. The process of calculating the standard MNI was challenged by the assemblages of both Viidumäe and Lepna. From the first, the remains of five non-adults were found based on metric differences between the femoral necks that, by first glance, would have seemed paired. By using the standard MNI, the result of non-adults would have been four, as it focuses mainly on counting the extant sides of the elements. In the case of Lepna, the standard MNI fell short in including all types of burials as the cremains of an adult were rendered invisible due to the fact that no burned teeth or pars petrosa had survived. Lepna also showed the slight disadvantage of using the petrous part of the temporal bone as the key element in calculating the MNI as it is difficult to differentiate between adult and juvenile elements.

Overall, when it comes to damaged remains such as those from Viidumäe and Lepna, it would be beneficial to use multiple elements during the calculation of standard MNI, for example the petrous part of temporal bone along with an element that could reflect the age of the individuals, e.g. the dentition. Attention should be also paid on possible differential burial methods as well as the metric differences between the same skeletal elements and it should, perhaps, become a standard practice to add measurements to the equation.

When assessing sex from the measurements of the long bones from Viidumäe, it quickly became clear that there is a need for more population-based standards. In the case of Lepna, where the morphological traits of the skull were observed, the results were also quite poor. Overall, as the methods of assessing sex from osteological material can be affected by the region, diet and normal biological variation, in the case of fragmented and commingled remains the best result would be gained from testing the repeating elements of the dentition for DNA.

The age assessment from dental wear was done using Brothwell´s (1963) chart. This method also showed some flaws with both the assemblage from Viidumäe as well as the assemblage from Lepna. From Viidumäe, a mandible that showed a case of clearly uneven wear was found. If the teeth had been separate and commingled as with a large amount of the rest of the sample, these results would have indicated the presence of two individuals in different age groups – 25 – 35 and 35 – 45. This, in turn intervenes with assessing the age groups of the population. From Lepna, an interesting case of unusual dental wear was found wherein instead of the occlusal surface, the sides of the molar had been worn down. Would that tooth have been loose, it would have been difficult to accurately assess the age from that type of wear.

The results gained from studying the dental development were disappointing in both cases as the age ranges provided by Ubelaker (1978) overlap too much to allow further differentiation between the age-at-death of non-adults. While the method works well on single skeletons with possibilities for cross-referencing, it didn´t perform as well on loose teeth, resulting in large age groups. As with the measurements of the long bones, a chart of dental development based on local population would be beneficial.

This study showed that there is still some room for improvement when it comes to the methodology of analysing commingled and fragmented remains, especially when it comes to more localized research.

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Kokkuvõte: Segatud ja fragmentaarsete luude osteoloogiline analüüs: kaks juhtumuuringut 6.–9. Sajandi Saaremaalt

Magistritöö käsitleb segatud ja fragmentaarsete luude osteoloogilist analüüsi. Töö keskendub valitud standardsete meetoditega saadud Viidumäe 7.–9. sajandi ja Lepna 6.–7. sajandi osteoloogiliste leidude populatsiooniprofiilidele. Lisaks annab töö ülevaate sellest, kuidas valitud meetodid, mida tavaliselt kasutatakse edukalt üksikute artikuleeritud luustike peal, toimivad segatud ja tugevasti kahjustunud luudel.

Viidumäe ohvripaik avastati 2014. aastal ning seda on korduvalt 2014.–2016. aasta jooksul uurinud arheoloog Marika Mägi. Viidumäe leiukompleks on eriline, kuna tegemist on võrdlemisi eraldatud alalt leitud inimtekkeliste konstruktsioonide, esemeohvrite ja inimluude leiupaigaga ning tänu omapärasele struktuurile on leidu interpreteeritud Eestis ainulaadse matusemajana. Lepna kompleksi avastas 2001.–2002. ning kaevas 2002.–2003. aastal Marika Mägi..

Kuigi Viidumäelt ja Lepnalt pärit luid on varem uuritud Raili Allmäe ja Jonathan Kalman, olid Viidumäe tulemused mõeldud vaid esialgseteks ning Lepna luude uurimine jäi poolikuks.

Magistritöö esimene peatükk annab ülevaate võimalike luude segunemise protsessidestja erinevatest segunenud luude tüüpidest koos ülevaatega segunenud luude uurimisajaloost. Samuti keskendutase laiemalt nii Viidumäe kui Lepna arheoloogilist kontekstile, toetudes Marika Mägi aruannetele ja artiklitele.

Teine sisupeatükk keskendub metoodikale ja materjalile, andes ülevaate kasutatud meetoditest indiviidide miinimumarvu (MNI), soo, vanuse ja terarelvast tingitud patoloogiate uurimiseks. Lisaks kirjeldatakse luumaterjali ning nendest tulenevaid metodoloogilisi piiranguidkoos ülevaatega materjali käsitlemisest.

Kolmas peatükk on tulemuste edasiandmine tabelite ja diagrammidena, mis edastavad elementide täpsed mõõdud ning kogused. Nii Viidumäe kui Lepna tulemused esitatakse alapeatükkides 3.1 ja 3.2, mis omakorda jaotuvad eraldi alapeatükkideks MNI, soo, täiskasvanute ja laste vanuse ning põlenud luude alusel. Lisaks on pildistatud ning kirjeldatud terarelvavigastustest tulenevaid patoloogiaid.

Neljandas peatükis arutletakse analüüsi tulemuste üle ning antakse edasi nii Viidumäe kui Lepna osteoloogiliste analüüside koondtulemused. Lisaks käsitletakse kasutatud meetodite komplikatsioone, sidudes need analüüsi käigus saadud kogemustega.

Uurimistöö andis mitmeid huvitavaid tulemusi – korrigeeriti nii Lepna kui Viidumäe minimaalset indiviidide arvu ning toodi esile miinimumarvu meeste ja naiste osakaalu matustes. Lisaks leiti miinimumarv indiviide ka nii täiskasvanute kui laste vanusegruppide seas. Hea tulemusena leiti kolm uut vägivallajuhtu Viidumäe puhul tuvastati needkahel keha skeletil ja ühe lapse põlvekedral. Üllatusena leiti üks vägivallajuhtum ka Lepnast ja lisaks ka vähemalt ühe täiskasvanu põletatud säilmed.

Testides MNI, soo ja vanuse määramiseks kasutatavaid meetodeid selgus, et segatud ja fragmentaarsete luude uurimine ja nendest põhjaliku ülevaate andmine on oluliselt raskendatud, kuna ühe skeleti elemente ei saa omavahel võrrelda. Samuti on meetoditel teatud komplikatsioonid, mis tulenevad nii populatsioonide erisusest kui ka näiteks dieedist ja matusekombestikust. Näiteks leidus Viidumäel hammaste erinevaid kulumisastmeid ühel alalõualuul ning Lepna puhul toitumisvälisest tegevusest tulenev eriline kulumismuster, mis mõjutab hammaste kulumise järgi vaadeldavate vanuste korrektsust.

Magistritöö annab põhjaliku ülevaate Viidumäe ja Lepna luuainese osteoloogilisest analüüsist koos kriitilise vaatega kasutatud meetoditest. Antud töö peamine eesmärk avada veelgi enam Viidumäe ja Lepna komplekside tausta ning anda mõningaid mõtteid segatud ja fragmentaarsete luude veelgi tõhusamaks uurimiseks on suure tõenäosusega täidetud.

Appendix 1. Viidumäe dentition

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
W12	3LRM	32	Molar	3d M	Mandibular	Right	17-25	Brothwell 1963	In mandible
W12	3LLM	17	Molar	3d M	Mandibular	Left	17-25	Brothwell 1963	In mandible
W12	2LLM	18	Molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	In mandible
W12	1LLM	19	Molar	1st M	Mandibular	Left	25-35	Brothwell 1963	In mandible
idk	3LLM	17	Molar	3d M	Mandibular	Left	17-25	Brothwell 1963	In mandible
idk	1LLM	19	Molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	In mandible
15	1LLM	19	Molar	1st M	Mandibular	Left	17-25	Brothwell 1963	In mandible
15	LLC	22	Canine	C	Mandibular	Left			In mandible
15	1LLM	19	Molar	1st M	Mandibular	Left	17-25	Brothwell 1963	In mandible
W8	2ULM	15	Molar	2nd M	Maxillary	Left	25-35	Brothwell 1963	In maxilla
W8	1ULM	14	Molar	1st M	Maxillary	Left	25-35	Brothwell 1963	In maxilla
W8	2ULPM	13	Premolar	2nd PM	Maxillary	Left			In maxilla
W8	URC	6	Canine	C	Maxillary	Right			In maxilla
W8	1URPM	5	Premolar	1st PM	Maxillary	Right			In maxilla
W8	2URPM	4	Premolar	2nd PM	Maxillary	Right			In maxilla
NI	3LLM	17	Molar	3d M	Mandibular	Left	25-35	Brothwell 1963	In mandible
NI	2LLM	18	Molar	2nd M	Mandibular	Left	25-35	Brothwell 1963	In mandible
NI	1LLM	19	Molar	1st M	Mandibular	Let	35-45/45+	Brothwell 1963	In mandible
NI	3LRM	32	Molar	3d M	Mandibular	Right	25-35	Brothwell 1963	In mandible
NI	2LRM	31	Molar	2nd M	Mandibular	Right	25-35	Brothwell 1963	In mandible
NI	1LRM	30	Molar	1st M	Mandibular	Right	25-35	Brothwell 1963	In mandible
NI	2LRPM	29	Premolar	2nd PM	Mandibular	Right	25-35	Brothwell 1963	In mandible
W12 (4)	3URM	1	Molar	3d M	Maxillary	Right	17-25	Brothwell 1963	In maxilla
W12 (4)	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	In maxilla
W12 (4)	1URM	3	Molar	1st M	Maxillary	Right	17-25	Brothwell 1963	In maxilla
NI (3)	3ULM	16	Molar	3d M	Maxillary	Left	17-25	Brothwell 1963	In maxilla
NI (3)	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	In maxilla

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
NI (3)	1ULM	14	Molar	1st M	Maxillary	Left	17-25	Brothwell 1963	In maxilla
W8 (2)	1LLM	19	Molar	1st M	Mandibular	Left	17-25	Brothwell 1963	chipped
W8 (2)	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	roots fused
W8 (2)	1ULM	14	Molar	1st M	Maxillary	Left	17-25	Brothwell 1963	2 roots broken
W8 (2)	1LRM	30	Molar	1st M	Mandibular	Right	6+/-24k	Ubelaker 1989	
W8 (2)	1LLPM	21	Premolar	1st PM	Mandibular	Left			
W8 (2)	1LRPM	28	Premolar	1st PM	Mandibular	Right			
W8 (2)	1LRPM	28	Premolar	1st PM	Mandibular	Right			root broken
W8 (2)			Premolar	1st PM?	Mandibular	Right?			chipped
W8 (2)	1LRPM	28	Premolar	1st PM	Mandibular	Right			root broken
W8 (2)	2LRPM	29	Premolar	2nd PM?	Mandibular	Right?			root broken
W8 (2)	2URPM	4	Premolar	2nd PM	Maxillary	Right			
W8 (2)	2URPM	4	Premolar	2nd PM	Maxillary	Right			
W8 (2)	LRC	27	Canine	C	Mandibular	Right			
W8 (2)	URC	6	Canine	C	Maxillary	Right			
W8 (2)	ULC	11	Canine	C	Maxillary	Left			3 x leh
W8 (2)	ULC	11	Canine	C	Maxillary	Left			break?
W8 (2)	2ULI	10	Incisor	2nd I	Maxillary	Left			
W8 (2)	1URI		Incisor	1st I	Maxillary	Right			
W8 (2)	2ULI	10	Incisor	2nd I	Maxillary	Left			
W8 (2)	2URI	7	Incisor	2nd I	Maxillary	Right			
W8 (2)	2ULI	10	Incisor	2nd I	Maxillary	Left			
W8 (2)	2LRI	26	Incisor	2nd I	Mandibular	Right			
W8 (2)	1LLPM	21	Premolar	1st PM	Mandibular	Left			chipped
W8 (2)	C		Canine	C					
W8 (2)									1 root tooth, very worn
W k 12	3ULM	16	Molar	3d M	Maxillary	Left	17-25	Brothwell 1963	In maxilla

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
W k 12	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	In maxilla
W k 12	1URM	3	Molar	1st M	Maxillary	Right	25-35	Brothwell 1963	
W k 12	1URM	3	Molar	1st M	Maxillary	Right	25-35	Brothwell 1963	
W k 12	1URM	3	Molar	1st M	Maxillary	Right	17-25	Brothwell 1963	
W k 12	1URM	3	Molar	1st M	Maxillary	Right	17-25	Brothwell 1963	
W k 12	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
W k 12	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	
W k 12	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	
W k 12	2URM	2	Molar	2nd M	Maxillary	Right	25-35	Brothwell 1963	
W k 12	1LRM	30	Molar	1st M	Mandibular	Right	25-35?	Brothwell 1963	
W k 12	1LRM	30	Molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
W k 12	3LRM	32	Molar	3d M	Mandibular	Right	17-25	Brothwell 1963	
W k 12	2LLM	18	Molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
W k 12	2LLM	18	Molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
W k 12	2LLI	23	Incisor	2nd I	Mandibular	Left			
W k 12	2LLI	23	Incisor	2nd I	Mandibular	Left			
W k 12	2LRI	26	Incisor	2nd I	Mandibular	Right			
W k 12	1LLI	24	Incisor	1st I	Mandibular	Left			
W k 12				SR					Molar, only root remaining
Sildita lahtised 11 keskel	2LLM	18	Molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	1LRM	30	Molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	1LLM	19	Molar	1st M	Mandibular	Left	17-25	Brothwell 1963	

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
Sildita lahtised 11 keskel	2LRM	31	Molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	1ULM	14	Molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	1ULM	14	Molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	3LLM	17	Molar	3d M	Mandibular	Left	17-25	Brothwell 1963	
Sildita lahtised 11 keskel	URC	6	Canine	C	Maxillary	Right			
Sildita lahtised 11 keskel	C		Canine	C					
Sildita lahtised 11 keskel	2URI	7	Incisor	2nd I	Maxillary	Right			
Sildita lahtised 11 keskel	1LRPM	28	Premolar	1st PM	Mandibular	Right			

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
Sildita lahtised 11 keskel	URPM		Premolar	1st PM?	Maxillary	Right			
Sildita lahtised 11 keskel	URPM		Premolar	1st PM?	Maxillary	Right			
Sildita lahtised 11 keskel	2LLPM	20	Premolar	2nd PM	Mandibular	Left	7+/-24k	Ubelaker 1989	
Sildita lahtised 11 keskel	C		Canine	C	Mandibular		7+/-24k	Ubelaker 1989	
W8 (4)	1URM	3	Molar	1st M	Maxillary	Right	17-25	Brothwell 1963	roots broken
W8 (4)	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	roots broken
W8 (4)	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	apex not fused
W8 (4)	3ULM	16	Molar	3d M	Maxillary	Left	17-25	Brothwell 1963	roots broken, mby 2nd M
W8 (4)	1LRM	30	Molar	1st M	Mandibular	Right	17-25	Brothwell 1963	roots broken
W8 (4)	1LRM	30	Molar	1st M	Mandibular	Right	17-25	Brothwell 1963	one root broken, apex?, chipped
W8 (4)	2LRM	31	Molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	paar, vb 3d M
W8 (4)	2LLM	18	Molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
W8 (4)	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	roots broken
W8 (4)	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	roots broken
W8 (4)	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	chipped
W8 (4)	3URM	1	Molar	3d M	Maxillary	Right	17-25	Brothwell 1963	roots broken
W8 (4)	2URPM	4	Premolar	2nd PM	Maxillary	Right			vähem kulunud
W8 (4)	2UPM		Premolar	2nd PM	Maxillary	Right?			rohkem kulunud
W8 (4)	UPM		Premolar	2nd PM?	Maxillary				chipped
W8 (4)	1ULPM		Premolar	1st PM	Maxillary	Left			

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
W8 (4)	UPM		Premolar	PM	Maxillary				chipped, root broken
W8 (4)	URC	6	Canine	C	Maxillary	Right			
W8 (4)	1URI		Incisor	1st I	Maxillary	Right			
W8 (4)	2LRI	26	Incisor	2nd I	Mandibular	Right			chipped
W8 (4)	2LRI	26	Incisor	2nd I	Mandibular	Right			chipped
W8 (4)	1LRI		Incisor	1st I	Mandibular	Right			chipped, paired
W8 (4)	1LLI	24	Incisor	1st I	Mandibular	Left			chipped
W8 (4)	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	2 pieces, root broken
S	1LLM	19	Molar	1st M	Mandibular	Left	17-25	Brothwell 1963	roots broken
S	1LRM	30	Molar	1st M	Mandibular	Right	-17	Ubelaker 1989	apex not closed
S	LLM		Molar	1st / 2nd M	Mandibular	Left	17-25	Brothwell 1963	mandible between roots
S	1LRPM	28	Premolar	1st PM	Mandibular	Right			chipped
S	2LLPM	20	Premolar	2nd PM	Mandibular	Left			apex not closed?
S	LRC	27	Canine	C	Mandibular	Right			root broken
S	ULC	11	Canine	C	Maxillary	Left			
S	C		Canine	C					root broken, mby child
S	1LLI	24	Incisor	1st I	Mandibular	Left			chipped
S				d					
S				d					
SO7	LRC	27	Canine	C	Mandibular	Right			2x leh, root broken
SO7	LC		Canine	C?	Mandibular				v worn, root broken
SO7	2LLPM	20	Premolar	2nd PM	Mandibular	Left			chipped
SO7	1LRPM	28	Premolar	1st PM	Mandibular	Right			root broken
SO7	1ULPM	12	Premolar	1st PM	Maxillary	Left			root broken
SO7	UPM		Premolar	1st PM?	Maxillary				chipped
SO7	UPM		Premolar	PM	Maxillary				chipped

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
SO7	1ULI		Incisor	1st I	Maxillary	Left			chipped
SO7	1ULI		Incisor	1st I	Maxillary	Left			chipped
W12	1LRM	30	Molar	1st M	Mandibular	Right	17-25?	Brothwell 1963	roots broken
W12	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	roots broken
W12	2RPM		Premolar	2nd PM		Right			
W12	1RPM		Premolar	1st PM		Right			
W12	RC		Canine	C		Right			
W k	2LLM	18	Molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
W 10 k	1URPM	5	Premolar	1st PM	Maxillary	Right			root broken
15	2LRM	31	Molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	caries
13	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	roots broken
13	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	
11	1ULM	14	Molar	1st M	Maxillary	Right	17-25	Brothwell 1963	root broken
11	2LRM	31	Molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	root broken
11	1URPM	5	Premolar	1st PM	Maxillary	Right			root broken
11	1LLPM	21	Premolar	1st PM	Mandibular	Left			root broken
11	2ULPM	13	Premolar	2nd PM	Maxillary	Left			
11	LLC	22	Canine	C	Mandibular	Left			root broken
SO7 (2)	1LRM	30	Molar	1st M	Mandibular	Right	25-35	Brothwell 1963	root broken
Luud 2	2ULM	15	Molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	roots broken
Luud 3	2URM	2	Molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
Luud 4	1LRPM	28	Premolar	1st PM	Mandibular	Right			root broken
SW9	1LLM	19	Molar	1st M	Mandibular	Left	25-35	Brothwell 1963	root broken
12 W k	2ULPM	13	Premolar	2nd PM	Maxillary	Left			two roots
12 W k	1ULPM	12	Premolar	1st PM	Maxillary	Left			
12 W k	UPM		Premolar	PM	Maxillary		9+/-24k	Ubelaker 1989	
12 W k	UPM		Premolar	PM	Maxillary				chipped

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
12 W k	2LRPM	29	Premolar	2nd PM	Mandibular	Right			
12 W k	1LLPM	21	Premolar	1st PM	Mandibular	Left			
12 W k	ULC	11	Canine	C	Maxillary	Left			root broken
12 W k	UC		Canine	C	Maxillary				chipped
12 W k	ULC	11	Canine	C	Maxillary	Left			
12 W k	URC	6	Canine	C	Maxillary	Right			root broken
12 W k	LRC	27	Canine	C	Mandibular	Right			
12 W k	2URI	7	Incisor	2nd I	Maxillary	Right			chipped
12 W k	2LLI	23	Incisor	2nd I	Mandibular	Left			root broken
12 W k	1LI		Incisor	1st I	Mandibular				chipped
12 W k				SR					only root remains
12 W k	3ULM	16	Molar	3d M	Maxillary	Left	17-25	Brothwell 1963	
12 W k	1LLM	19	Molar	1st M	Mandibular	Left	17-35	Brothwell 1963	chipped
12 W k	LM		Molar	M	Mandibular		?		chipped
12 W k	1LLM	19	Molar	1st M	Mandibular	Left	17-25	Brothwell 1963	root broken
12 W k	UPM		Premolar	PM	Maxillary				root broken, worn
12 W k	LPM		Premolar	PM	Mandibular	Right?			very worn
12 W k	ULC	11	Canine	C	Maxillary	Left			root broken, chipped
12 W k	URC	6	Canine	C	Maxillary	Right?			very worn, root broken, chipped
12 W k	2ULI	10	Incisor	2nd I	Maxillary	Left			root broken, chipped
12 W k	1URPM	5	Premolar	1st PM	Maxillary	Right	8+/-24k	Ubelaker 1989	
11	LLC	22	Canine	C	Mandibular	Left	6+/-24k	Ubelaker 1989	
11	1UI		Incisor	1st I	Maxillary				root broken, very worn
4,5+laps	2LRdM	T	Molar	Rd2nd M	Mandibular	Right	6+/-24k	Ubelaker 1989	one root broken
4,5+laps	1LRdM	S	Molar	Rd1st M	Mandibular	Right	6-9	Ubelaker 1989	
4,5+laps	1LRdM	S	Molar	Rd1st M	Mandibular	Right	6-9	Ubelaker 1989	root broken, chipped

Find	Code	No	Type	Tooth	Position	Side	Age estimation	Source	Notes
4,5+laps	LRdC	R	Canine	dC	Mandibular	Right?	6-8	Ubelaker 1989	root chipped
4,5+laps	1LRM	30	Molar	1st M	Mandibular	Right	6-7	Ubelaker 1989	
4,5+laps	2LRM	31	Molar	2nd M	Mandibular	Right	7+/-24	Ubelaker 1989	
4,5+laps	2LRM	31	Molar	2nd M	Mandibular	Right	7+/-24	Ubelaker 1989	
4,5+laps	2URM	2	Molar	2nd M	Maxillary	Right	7+/-24	Ubelaker 1989	
4,5+laps	1LRPM	28	Premolar	1st PM	Mandibular	Right	8+/-24k	Ubelaker 1989	
4,5+laps	1ULPM	12	Premolar	1st PM	Maxillary	Left	7+/-24	Ubelaker 1989	
4,5+laps	1LLPM	21	Premolar	1st PM	Mandibular	Left	?	Ubelaker 1989	chipped, root broken
4,5+laps	LRC	27	Canine	C	Mandibular	Right	8+/-24k	Ubelaker 1989	
4,5+laps	URC	6	Canine	C	Maxillary	Right	8+/-24k	Ubelaker 1989	
4,5+laps	2LRI	26	Incisor	2nd I	Mandibular	Right	6+/-24k	Ubelaker 1989	
4,5+laps	2LLI	23	Incisor	2nd I	Mandibular	Left	6+/-24k	Ubelaker 1989	
4,5+laps	LRC	27	Canine	C	Mandibular	Right			root broken
4,5+laps	1UI		Incisor	1st I	Maxillary		8+/-24k	Ubelaker 1989	chipped
SW9	3LLM	17	Molar	3d M	Mandibular	Left?	25-35	Brothwell 1963	chipped
W8 (5)	LRPM		Premolar	PM	Mandibular	Right			cut
W8 (5)	2LRI	26	Incisor	2nd I	Mandibular	Right?			cut
W8 (5)	SR		SR						cut, root remaining
4,5+laps (2)	2LLM	18	Molar	2nd M	Mandibular	Left	7+/-24	Ubelaker 1989	in mandible
4,5+laps (2)	1LLM	19	Molar	1st M	Mandibular	Left	7+/-24	Ubelaker 1989	in mandible
4,5+laps (2)	2LLdM	K	Molar	Md2	Mandibular	Left	7+/-24	Ubelaker 1989	in mandible
4,5+laps (2)	1LLdM	L	Molar	Md1	Mandibular	Left	7+/-24	Ubelaker 1989	in mandible
4,5+laps (2)	2LRdM	T	Molar	Md2	Mandibular	Right	7+/-24	Ubelaker 1989	in mandible

Appendix 2. Lepna dentition.

Sq.		Nr.	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
		ni	2LRM	31	molar	2nd M	Mandibular	Right	7	Ubelaker 1989	No root
		ni	1LRPM	28	premolar	1st PM	Mandibular	Right			
		ni				SR	x2				
		ni				SR					
		ni				SR					
		ni				1st M	Maxillary	Left			
N8		2	1URM	3	molar	1st M	Maxillary	Right	25-35	Brothwell 1963	In maxilla
N8		2	2URM	2	molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
N8		2	1URM	3	molar	1st M	Maxillary	Right	25-35	Brothwell 1963	In testing
M11		3	3LLM	17	molar	3d M	Mandibular	Left	17-25	Brothwell 1963	
N14		8	1LLM	19	molar	1st M	Mandibular	Left	35-45	Brothwell 1963	
M18		15	2ULPM	13	premolar	2nd PM	Maxillary	Left			
P19		42									Single root left
P19		42	2URM	2	molar	2nd M	Maxillary	Right	45+	Brothwell 1963	
P15		45	1ULM	14	molar	1st M	Maxillary	Left	35-45	Brothwell 1963	
I14		54									
K16		55	1LLM	19	molar	1st M	Mandibular	Left	25-35	Brothwell 1963	
K16		55	1LRPM	28	premolar	2nd PM	Mandibular	Right			
K16		55	1LLM	19	molar	1st M	Mandibular	Left	35-45	Brothwell 1963	
K16		55	URC	6	canine	C	Maxillary	Left			
K16		58	2URI	7	incisor	I	Maxillary	Right	4	Ubelaker 1989	
K16		58			premolar	2nd PM	Maxillary		5-6	Ubelaker 1989	
K16		58			dec molar	1st DM	Maxillary		8	Ubelaker 1989	deciduous

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
N18		65	2LRM	31	molar	2nd M	Mandibular	Right	17-25		
M17		79	1URPM	5	premolar	1st PM	Maxillary	Right?			
T18		92	1URPM	5	premolar	1st PM	Maxillary	Right?			
R16		120	1URM	3	molar	1st M	Maxillary	Right	5-6	Ubelaker 1989	
R14		122			premolar	PM	Maxillary				
R14		122			premolar	PM	Maxillary				Two bone fragments
R14		122	URC	6	canine	C	Maxillary	Right			
R15		123	2URI	7	incisor	2nd I	Maxillary	Right			
M15		131			premolar	PM	Maxillary				Weird growth on root?
		136		1LRM	molar	1st M	Mandibular	?	45 +	Brothwell 1963	
		136	ULC	11	canine	C	Maxillary	Left			
		137	2LRM	31	molar	2nd M	Mandibular	Right	25-35	Brothwell 1963	
		137	1LRPM	28	premolar	1st PM	Mandibular	Right			
		137	1LLI	24	incisor	1st I	Mandibular	Left			
		138			canine	C					
		138			canine	C					
		140			canine	C					
		142	1LLI	24	incisor	1st I	Mandibular	Left?			
		142									Postmortem breaking
		142	1ULM	14	molar	1st M	Maxillary	Left	45+	Brothwell 1963	
		143			molar	M			45+	Brothwell 1963	
		144	2ULM	15	molar	2nd M	Maxillary	Left	45+	Brothwell 1963	
		145	1ULI	9	incisor	1st I	Maxillary	Left	6-7	Ubelaker 1989	In maxilla
		145	1ULI	9	incisor	1st I	Maxillary	Left	6-7	Ubelaker 1989	In maxilla
		145	1LLPM	21	premolar	1st PM	Mandibular	Left			
		147	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
		148	URC	6	canine	C	Maxillary	Right			

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
		148	1LLPM	21	premolar	2nd PM	Mandibular	Left			
N8		150	2ULM	15	molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	
N8		150			premolar	PM	Maxillary				
N13		158	1ULM	14	molar	1st M	Maxillary	Left	9	Ubelaker 1989	
O13		170									Root remaining
N13		171	LLC	22	canine	C	Mandibular	Left			
N13		171	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
N13		172	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	In testing
N13		172	1LLM	19	molar	1st M	Mandibular	Left	35-45	Brothwell 1963	
N13		172	1LRM	30	molar	1st M	Mandibular	Right	3	Ubelaker 1989	
N13		172	1ULM	14	molar	1st M	Maxillary	Left	3	Ubelaker 1989	
N13		173			premolar	1st PM	Maxillary	Left			
N9		176			molar	1st M	Mandibular	Left	25-35	Brothwell 1963	
P13		184	2LLM	31	molar	2nd M	Mandibular	Left?	17-25	Brothwell 1963	In mandible
P13		184			molar	1st M	Mandibular	Right	45+	Brothwell 1963	
P13		184	1LRM	30	molar	1st M	Mandibular	Right	35-45	Brothwell 1963	
P13		184	1LLI	24	incisor	1st I	Mandibular	Left			
M12		185	LLC	22	canine	C	Mandibular	Left			
M12		185	1LLM	19	molar	1st M	Mandibular	Left	17-25	Brothwell 1963	
M12		185	1LRM	30	molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
M12		185			molar	2nd DM	Mandibular	Right?	7-8	Brothwell 1963	
		187	LLC	22	canine	C	Mandibular	Left			
		187	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
		187			premolar	PM	Maxillary	Right?	6	Ubelaker 1989	
N11		189	2ULM	15	molar	2nd M	Maxillary	Left			
N11		189	3LRM	32	molar	3d M	Mandibular	Right	11	Ubelaker 1989	In mandible, erupting
N12		191			molar	1st M	Mandibular	Right	25-35	Brothwell 1963	

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
		199	ULC	11	canine	C	Maxillary	Left			
		199	LRC	27	canine	C	Mandibular	Right			
		199	LRC	27	canine	C	Mandibular	Right			
		199	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
		199	1ULM	14	molar	1st M	Maxillary	Left	25-35	Brothwell 1963	
		199	1URI	9	incisor	1st I	Maxillary	Right			
		199	2LRPM	29	premolar	2nd PM	Mandibular	Right			
		199	1LLI	24	incisor	1st I	Mandibular	Left?			
N12		200	URC	6	canine	C	Maxillary	Right	7-8	Ubelaker 1989	
N12		200	2URM	2	molar	2nd M	Maxillary	Right	13-15	Ubelaker, smith	4 roots
N12		200	1URI	8	incisor	1st I	Maxillary	Right			
M12		201	1LLPM	21	premolar	1st PM	Mandibular	Left			
M12		201	2ULM	15	molar	1st M	Maxillary	Left			
M12		201	3ULM	16	molar	3d M	Maxillary	Left	17-35	Brothwell 1963	
M12		202	1LLPM	21	premolar	1st PM	Mandibular	Left			
M12		202	2URI	7	incisor	2nd I	Maxillary	Right			
M12		202	2URPM	4	premolar	2nd PM	Maxillary	Right?			
M12		202			molar	M	Mandibular		45+	Brothwell 1963	
M12		202	3ULM	16	molar	3d M	Maxillary	Left?	15	Ubelaker 1989	
M12		202	3LLM	17	molar	3d M	Mandibular	Left	25-35	Brothwell 1963	In mandible
M12		202	1LLM	19	molar	1st M	Mandibular	Left	25-35		In mandible
M12		202	3LRM	32	molar	3d M	Mandibular	Right	25-35	Brothwell 1963	In mandible
M12		202	2LRM	31	molar	2nd M	Mandibular	Right	25-35	Brothwell 1963	In mandible, in testing
N13		215	1URM	3	molar	1st M	Maxillary	Right	25-35	Brothwell 1963	
N13		215	1ULI	9	incisor	1st I	Maxillary	Left			
N13		215	2URPM	4	premolar	2nd PM	Maxillary	Right?			
N13		215	URC	6	canine	C	Maxillary	Right			

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
M13		216	LRC	27	canine	C	Mandibular	Right			
N12		217	2LLI	23	incisor	2nd I	Mandibular	Left	5	Ubelaker 1989	
N12		217	1LLPM	21	premolar	1st PM	Mandibular	Left	Child	Ubelaker 1989	
N12		217	1URPM	5	premolar	1st PM	Maxillary	Right			
N12		217	2LRM	31	molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	In testing
N12		217			molar	1st DM	Mandibular	Right			
N12		217	1URM	3	molar	1st M	Maxillary	Right	17-25	Brothwell 1963	In testing
N12		217	LLC	22	canine	C	Mandibular	Left	5+/-16	Ubelaker 1989	
N12		217	LRC	27	canine	C	Mandibular	Right			
M13		218	LRC	27	canine	C	Mandibular	Right	11+/-30k	Ubelaker 1989	
M13		218	URC	6	canine	C	Maxillary	Right			
M13		218	2ULPM	13	premolar	2nd PM	Maxillary	Left			
M13		218	1LRM	30	molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
M13		218	1LRM	30	molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
M13		218	1LLPM	21	premolar	1st PM	Mandibular	Left			
M13		218			premolar	PM					
M13		218	2LRI	26	incisor	2nd I	Mandibular	Right			
M12		219			molar	M?					
N11		222	2ULI		incisor	2nd I	Maxillary	Left			
N11		222			incisor	2nd I	Maxillary?				
N11		222			premolar	PM	Mandibular				
N11		223	1LLPM	21	premolar	1st PM	Mandibular	Left			
O12		234	ULC	11	canine	C	Maxillary	Left			
O12		234			molar	2nd? M	Maxillary	Left?	45+	Brothwell 1963	
O12		234			molar	2nd DM	Maxillary	Right	8	Ubelaker 1989	
O12		234	2LRM	31	molar	2nd M	Mandibular	Right	25-35	Brothwell 1963	
O12		234	1URM	3	molar	1st M	Maxillary	Right	17-25	Brothwell 1963	

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
O12		236			premolar	PM	Maxillary				
O12		236	1LRM	30	molar	1st M	Mandibular	Right	25-35	Brothwell 1963	
N11		238	1LLM	19	molar	1st M	Mandibular	Left	5	Ubelaker 1989	
N11		238	2ULI	7	incisor	2nd I	Maxillary	Left	4-5	Ubelaker 1989	
N11		238	ULC	11	canine	C	Maxillary	Left	5-6	Ubelaker 1989	
N11		238	URC	6	canine	C	Maxillary	Right			
P12		238	1LLI	24	incisor	1st I	Mandibular	Left?			
P12		239									Root only
P12		239	1ULM	14	molar	1st M	Maxillary	Left	25-35	Brothwell 1963	
P12		239	1LLM	19	molar	1st M	Mandibular	Left	17-25	Brothwell 1963	
P12		239	2LRPM	29	premolar	2nd PM	Mandibular	Right			
P12		239			molar	M					
P12		239			incisor	1st I	Mandibular				
T9		240			premolar	PM	Maxillary	Right			
P11		248	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
P11		248	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
P11		248	1ULM	14	molar	1st M	Maxillary	Left	5-6	Ubelaker 1989	
P11		248			premolar	PM					
P11		248			incisor	1st I	Mandibular				
P11		248	1LRI	25	incisor	1st I	Mandibular	Right			
P11		248	1LLI	24	incisor	1st I	Mandibular	Left	7	Ubelaker 1989	
R10		249	1URI	8	incisor	1st I	Maxillary	Right			
P9		251			molar	M	Mandibular		45+	Brothwell 1963	
O12		258	2ULI	23	incisor	2nd I	Maxillary	Left	6-7	Ubelaker 1989	
O12		258			molar	1st DM	Mandibular	Right	3-4	Ubelaker 1989	deciduous
O12		258			molar	1st DM	Mandibular	Right	4-6	Ubelaker 1989	deciduous
O12		258			premolar	2nd PM	Maxillary				

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
O12		258	URC	6	canine	C	Maxillary	Right			
P12		262	1LRM	30	molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
P12		262									
O13		264			molar	M			11-12	Ubelaker 1989	
P12		265	1URM	3	molar	1st M	Maxillary	Right	25-35	Brothwell 1963	
P12		265	1ULPM	12	premolar	1st PM	Maxillary	Left	12	Ubelaker 1989	
P12		265			premolar	PM					
P12		265			molar	M			45+	Brothwell 1963	
P12		265			molar	M	Mandibular		45+	Brothwell 1963	Root only
P12		265	2URM	2	molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
P12		265	1LLM	19	molar	1st M	Mandibular	Left	-17	Ubelaker 1989	No root
P12		265	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	No root
R10		272	2ULI	10	incisor	2nd I	Maxillary	Left			In maxilla
R10		272	2URI	7	incisor	2nd I	Maxillary	Right			In maxilla
R10		272	2ULPM	13	premolar	2nd PM	Maxillary	Left			In maxilla
R10		272	1ULM	14	molar	1st M	Maxillary	Left	35-45	Brothwell 1963	In maxilla
R10		272	2ULM	15	molar	2nd M	Maxillary	Left	45+	Brothwell 1963	In maxilla
R10		272			molar	2nd DM	Mandibular	Left	-17	Ubelaker 1989	Deciduous
K10		273									
N9		278	2LLPM	20	premolar	2nd PM	Mandibular	Left?			
N9		278	2LLM	18	molar	2nd M	Mandibular	Left?	45+	Brothwell 1963	
N9		278			molar	M	Mandibular				
N9		278	1LRI	25	incisor	1st I	Mandibular	Right			
M9		280	LLC	22	canine	C	Mandibular	Left			
N14		281	1URPM	5	premolar	1st PM	Maxillary	Right			
N14		281	1LLI	24	incisor	1st I	Mandibular	Left			
N14		282	1LLI	24	incisor	1st I	Mandibular	Left			

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
N14		282	URC	6	canine	C	Maxillary	Right			
		283	1URM	3	molar	1st M	Maxillary	Right	17-25	Brothwell 1963	
		283	1ULM	14	molar	1st M	Maxillary	Left	25-35	Brothwell 1963	
		283			molar	DC	Mandibular	Left	6	Ubelaker 1989	
		283	1ULPM	12	premolar	1st PM	Maxillary	Left			No root
		283	2LLPM	20	premolar	2nd PM	Mandibular	Left			
O14		284	2ULI	10	incisor	2nd I	Maxillary	Left			Apex possibly open
O14		284	1LLM	19	molar	1st M	Mandibular	Left	25-35	Brothwell 1963	
O14		284	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
O14		284	ULC	11	canine	C	Maxillary	Left			
O14		284	ULC	11	canine	C	Maxillary	Left			
P12		286	URC	6	canine	C	Maxillary	Right			
P12		286	LLC	22	canine	C	Mandibular	Left			
P12		287	URC	6	canine	C	Maxillary	Right			
P12		287	2ULPM	13	premolar	2nd PM	Maxillary	Left?			
P12		287	2LRPM	29	premolar	2nd PM	Mandibular	Right			
P12		287	1LRM		molar	M	Mandibular	Right	25-35	Brothwell 1963	
P12		287	2ULM	15	molar	2nd M	Maxillary	Left	25-35	Brothwell 1963	
P12		287	2URM	2	molar	2nd M	Maxillary	Right	6	Ubelaker 1989	
N11		290	1URM	3	molar	1st M	Maxillary	Right	17-25	Brothwell 1963	In testing
N11		290	2URM	2	molar	2nd M	Maxillary	Right	-17	Ubelaker 1989	
		291	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
		291	1LLM	19	molar	1st M	Mandibular	Left	17-25	Brothwell 1963	
		291	1LRM	30	molar	1st M	Mandibular	Right	25-35	Brothwell 1963	Post-mortem break, mesial (interproximal)
		291	1URPM	5	premolar	1st PM	Maxillary	Right			
		291	1LLPM	21	premolar	1st PM	Mandibular	Left			

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
R11		294	2LRI	26	incisor	2nd I	Mandibular	Right			Wearing on the lingual side, polishing on the buccal side
P12		295	2LLM	18	molar	2nd M	Lowel	Left	17-25	Brothwell 1963	
P12		295	2LRPM	29	premolar	2nd PM	Mandibular	Right			Intravitam chipping on mesial, possible postmortem damage on lateral interproximal
		297	1URM		molar	M	Maxillary		45+	Brothwell 1963	
		297	ULC	11	canine	C	Maxillary	Vasak			
R11		299			canine	C	VA/PY				
R10		300	1LRM	30	molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
R10		300	2LRM	31	molar	2nd M	Mandibular	Right	35-45	Brothwell 1963	
P11		302	LRC	27	canine	C	Mandibular	Right			
N12		304	LLC	22	canine	C	Mandibular	Left			
N12		304			molar	1st DM	Mandibular	Right	6-8	Ubelaker 1989	Deciduous
N13		306	2LRM	31	molar	2nd M	Mandibular	Right	6-7	Ubelaker 1989	Wear on the labial side
N13		306	2LLM		molar	2nd M	Mandibular ?	Left?	17-25	Brothwell 1963	
N13		306	2ULM	15	molar	2nd M	Maxillary	Left	7	Ubelaker 1989	
N13		306			molar	M	Mandibular				
N14		307	1LLM	19	molar	1st M	Mandibular	Left	17-25		
P12		308	URC	6	canine	C	Maxillary	Right			Enamel defect, furrows
P12		308			incisor	2nd I	Maxillary?	Right	8-9	Ubelaker 1989	
P12		308			premolar	1st PM	Mandibular	Left?	5	Ubelaker 1989	
P12		308			molar	1st M	Maxillary	Right?	3	Ubelaker 1989	
P12		308	1LRM	30	molar	1st M	Mandibular	Right	3	Ubelaker 1989	
P12		308	1ULM	14	molar	1st M	Maxillary	Left	7-8	Ubelaker 1989	

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
P12		308	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
P12		308			premolar	1st PM	Maxillary				
O12		309	1URM	3	molar	1st M	Maxillary	Right	4	Ubelaker 1989	Carabelli cusp
O12		309	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	Post-mortem chipping
R12		310			premolar	PM	Mandibular	?			
R11		312	2LRM	31	molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	
O11		316	1URI	8	incisor	1st I	Maxillary	Right			
O11		316	2URM		molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
O11		316	1ULM	14	molar	1st M	Maxillary	Left	25-35	Brothwell 1963	
O11		316			premolar	PM	Mandibular	?			
O11		316			molar	1st DM	Maxillary	Left	3-9	Ubelaker 1989	In maxilla, deciduous
O11		316			premolar	2nd PM	Maxillary	Right		Ubelaker 1989	
N13		317	1ULM	14	molar	1st M	Maxillary	Left	35-45	Brothwell 1963	Extra root distal between buccal and lingual, attached to buccal
N13		317	1LRM	30	molar	1st M	Mandibular	Right	7-9	Ubelaker 1979	
N13		317	3LRM	32	molar	3d M	Mandibular	Right	17-25	Brothwell 1963	Extra root buccal attached to mesial
N13		317			molar	2nd M	Mandibular		17-25	Brothwell 1963	
N13		317	URC	6	canine	C	Maxillary	Right			
N13		317	LRC	27	canine	C	Mandibular	Right			
N12		318	ULC	11	canine	C	Maxillary	Left			
N12		318	2URI	7	incisor	2nd I	Maxillary	Right	8	Ubelaker 1989	
N12		318	1URM	3	molar	1st M	Maxillary	Right	35-45	Brothwell 1963	
N12		318	2URM	2	molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
O12		319	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
O12		319	1URM	3	molar	1st M	Maxillary	Right	9	Ubelaker 1989	

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
O12		319	2LRM	31	molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	
O12		319			incisor	1st I	Mandibular				
O12		319			molar	DM					
P13		320			premolar	2nd PM	Mandibular				
P13		320	1LRM	30	molar	1st M	Mandibular	Right	25-35	Brothwell 1963	
N14		321	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
P10		322	ULC	11	canine	C	Maxillary	Left			
O13		325	1ULI	9	incisor	1st I	Maxillary	Left			
O13		325	1LRPM	28	premolar	1st PM	Mandibular	Right			
P10		329	2URI	7	incisor	2nd I	Maxillary	Right?			
P10		329			premolar	PM					
O10		330			premolar	1st PM	Maxillary	Right?			
R11		333	LRC	27	canine	C	Mandibular	Right			
R11		333			molar	3d M	Mandibular		12	Ubelaker 1989	
R11		333	2LRM	31	molar	2nd M	Mandibular	Right	25-35	Brothwell 1963	
N14		334	3ULM	16	molar	3d M	Maxillary	Left	17-25	Brothwell 1963	Roots fused
N14		334	2LLPM	20	premolar	2nd PM	Mandibular	Left			
N14		334			premolar	PM	Maxillary				
P13		335A	1ULI	9	incisor	1st I	Maxillary	Left			
P11		336A	1LRM	30	molar	1st M	Mandibular	Right	25-35	Brothwell 1963	
P11		336A			molar	M	Mandibular	?			
P11		336A			molar	M	Mandibular	?			
P11		336A	2LRPM	29	premolar	2nd PM	Mandibular	Right			
P11		336B			premolar	PM	Maxillary				In maxilla
P11		336B			premolar	PM	Maxillary				In maxilla, root only
P11		336B			premolar	2nd PM	Mandibular	Right			

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
P11		336B			premolar	2nd PM	Mandibular				
P11		336B	1LRM	30	molar	1st M	Mandibular	Right	25-35	Brothwell 1963	
P11		336B	1LRM	30	molar	1st M	Mandibular	Left			
P11		336B	1LLPM	21	premolar	1st PM	Mandibular	Left	10-11	Ubelaker 1989	
P11		336B	2URPM	4	premolar	2nd PM	Maxillary	Right	6	Ubelaker 1989	
P11		336B	2URM	2	molar	3d M	Maxillary	Right			
P11		336B	URC	6	canine	C	Maxillary	Right			
O11		337	LRC	27	canine	C	Mandibular	Right			
O11		337	LLC	22	canine	C	Mandibular	Left			
O11		337	2ULM	15	molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	
O11		337	2LRPM	29	premolar	2nd PM	Mandibular	Right?	12-	Ubelaker 1989	
O11		337				SR					
O11		337	1LLM	19	molar	1st M	Mandibular	Left	35-45	Brothwell 1963	
O11		337	1LLM	19	molar	1st M	Mandibular	Left?			
O11		337	1URM	3	molar	1st M	Maxillary	Right	17-25	Brothwell 1963	
O12		338	2URI	7	incisor	2nd I	Maxillary	Right			
O12		338	2URI	7	incisor	2nd I	Maxillary	Right?			
O12		338	1ULM	14	molar	1st M	Maxillary	Left	25-35	Brothwell 1963	In testing
O12		338	2URM	2	molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
O12		338	2LRM	31	molar	2nd M	Mandibular	Right	25-35	Brothwell 1963	
O12		338	1LRPM	28	premolar	1st PM	Mandibular	Right			
O12		338			premolar	PM	Mandibular				
O12		338	3ULM	15	molar	3d M	Maxillary	Left	35-45	Brothwell 1963	Two roots
O12		338	1LRI	25	incisor	1st I	Mandibular	Right			
O12		338	1ULPM	12	premolar	1st PM	Maxillary	Left	5	Ubelaker 1989	
		339	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
		339	1LLM	19	molar	1st M	Mandibular	Left	17-25	Brothwell 1963	
		339	1LRM	30	molar	1st M	Mandibular	Right	17-25	Brothwell 1963	
		339	1LLPM	21	premolar	1st PM	Mandibular	Left			
		339	1ULPM		premolar	PM	Maxillary				
N12		340	LRC	27	canine	C	Mandibular	Right			
N12		340	1LRPM	28	premolar	1st PM	Mandibular	Right			
N12		340	1URM	3	molar	1st M	Maxillary	Right	-25	Brothwell 1963	
O13		342			incisor	2nd I	Mandibular	Right?			
O13		342			premolar	PM	Maxillary?	Right?			
N12		347	1ULPM	12	premolar	1st PM	Maxillary	Left			
O11		349	ULC	11	canine	C	Maxillary	Left			
O11		349	2LRM	31	molar	2nd M	Mandibular	Right	8	Ubelaker 1989	
O11		349	1URPM	5	premolar	1st PM	Maxillary	Right	5	Ubelaker 1989	
O11		349			incisor	I	Maxillary	Left			
O11		349			canine	DC					deciduous
O11		349	2URM	2	molar	2nd M	Maxillary	Right	25+	Brothwell 1963	
O11		349	3ULM	16	molar	3d M	Maxillary	Left			
O11		349			molar	1st DM	Mandibular				deciduous
O11		349	1URI	8	incisor	1st I	Maxillary	Right			
O11		349	1ULPM	12	premolar	1st PM	Maxillary	Left			Two roots
O11		349			premolar	PM	Mandibular				
O11		349			molar	M	Mandibular				No root
O11		349			premolar	PM	Maxillary				
S10		350	1ULM	14	molar	1st M	Maxillary	Left?	25-35	Brothwell 1963	
P12		351	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	Three roots
P12		351	1LRM	30	molar	1st M	Mandibular	Right?	25-35	Brothwell 1963	

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
P12		351			premolar	PM	Maxillary	Left	5-6	Ubelaker 1989	In maxilla
P12		351			premolar	PM	Maxillary	Left	5-6	Ubelaker 1989	In maxilla
P12		351	LLC	22	canine	C	Mandibular	Left			
P12		351	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	Fused roots
P12		351			molar	1st DM	Maxillary	Left	8	Ubelaker 1989	deciduous
P12		351	1URPM	5	premolar	1st PM	Maxillary	Right			
P12		351			premolar	PM					
P12		351			premolar	PM					
P12		351			premolar	PM	Maxillary				
P12		351	2ULI	10	incisor	2nd I	Maxillary	Left			
P12		351	2ULI	10	incisor	2nd I	Maxillary	Left			
M14		353			molar	1st DM	Mandibular	Left	Approx. 7	Ubelaker 1989	In mandible
M14		353	2LLI	23	incisor	2nd I	Mandibular	Left	u 7	Ubelaker 1989	In mandible
M14		353	2LRI	26	incisor	2nd I	Mandibular	Right	u 7	Ubelaker 1989	In mandible
M14		353	LLC	22	canine	C	Mandibular	Left	u 7	Ubelaker 1989	In mandible
M14		353	1LLPM	21	premolar	1st PM	Mandibular	Left	u 7	Ubelaker 1989	In mandible
M14		353			molar	1st DM	Mandibular	Right	u 7	Ubelaker 1989	deciduous
M14		353	2LRPM	29	premolar	2nd PM	Mandibular	Right?	u 7	Ubelaker 1989	
M14		353	LRC	27	canine	C	Mandibular	Right?	u 7	Ubelaker 1989	
M14		353			molar	DM					deciduous
M14		353	1ULM	14	molar	1st M	Maxillary	Left	25-35	Brothwell 1963	Fused roots
O12		354			molar	1st DM	Mandibular	Left	9-10	Ubelaker 1989	In mandible
O12		354	1LLM	19	molar	1st M	Mandibular	Left	9-10	Ubelaker 1989	In mandible
O12		354	1UM	14	molar	1st M	Maxillary				In maxilla
O12		354			premolar	2nd PM	Maxillary	Left?	5-6	Ubelaker 1989	
O12		354			molar	M					

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
O12		354	2URM	2	molar	2nd M	Maxillary	Right			
O12		354	2URPM		premolar	2nd PM	Maxillary	Right?			
O12		354	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	
O12		354	2LRPM	29	premolar	2nd PM	Mandibular	Right			
O12		354			premolar	PM					Two roots
O12		354				SR					
O12		354			molar	M	Mandibular				
O12		354	2LRI	26	incisor	2nd I	Mandibular	Right			
O12		354	1LRI	25	incisor	1st I	Mandibular	Right?			
O12		354	1ULI	9	incisor	1st I	Maxillary	Left			
P13		355B	LRC		canine	C	Mandibular	Right			
P13		355B			premolar	2nd PM	Maxillary	Right?			
P13		355B	1LRM	30	molar	1st M	Mandibular	Right	-25		
P13		358	1LRM	30	molar	1st M	Mandibular	Right	3-4	Ubelaker 1989	11,09x9,68
P13		358	1LLM	19	molar	1st M	Mandibular	Left	3-4	Ubelaker 1989	12,03x10,31
P13		358	2LLM	18	molar	2nd M	Mandibular	Left?	6-7	Ubelaker 1989	9,85x8,64
P13		358	1URPM	5	premolar	2nd PM	Maxillary	Right			
P13		358			incisor	DI					deciduous
P13		358			canine	DC					deciduous
P13		359			incisor	DI					deciduous
P13		359	LLC	22	canine	C	Mandibular	Left			
P13		359	1URM	3	molar	1st M	Maxillary	Right	35-45	Brothwell 1963	
P13		359			premolar	PM	Maxillary				
P13		359				SR					Might be decidious/animal
P13		359			premolar	2nd PM	Maxillary				

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
P13		359	1URPM	5	premolar	1st PM	Maxillary	Right			
L14		361	2LLM	18	molar	2nd M	Mandibular	Left	-25		
L14		361			premolar	PM	Maxillary				
L14		361			premolar	PM					
P13		362	1LLPM	21	premolar	1st PM	Mandibular	Left			In mandible
P13		362	2LLPM	20	premolar	2nd PM	Mandibular	Left			In mandible
P13		362	1LLM	19	molar	1st M	Mandibular	Left	25-35	Brothwell 1963	In mandible
P13		362	2LLM	18	molar	2nd M	Mandibular	Left	17-25	Brothwell 1963	In mandible
P13		362	3LLM	17	molar	3d M	Mandibular	Left	17-25	Brothwell 1963	In mandible
P13		362	LLC	22	canine	C	Mandibular	Left			
P13		362			molar	2nd M	Mandibular	Left?	7	Ubelaker 1989	11,59x10,29
P13		362	1ULM		molar	1st M	Maxillary	Left			
P13		362	1URPM	5	premolar	1st PM	Maxillary	Right			
P13		363				VAC/V2I/ animal					
P13		363			incisor	2nd I	Mandibular	Left?			
P13		363				SR		Left?			
P13		363	2LRM	31	molar	2nd M	Mandibular	Right	17-25	Brothwell 1963	
P13		363			premolar	PM	Maxillary?				
P13		363	1URM	3	molar	1st M	Maxillary	Right	17-25	Brothwell 1963	
O15		366	3ULM	15	molar	3d M	Maxillary	Left	17-25	Brothwell 1963	In maxilla
O15		366	2ULM	15	molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	In maxilla
O15		366	1ULM	14	molar	1st M	Maxillary	Left	25-35	Brothwell 1963	In maxilla, in testing
O15		366	2ULM	15	molar	2nd M	Maxillary	Left	17-25	Brothwell 1963	
O15		366			incisor	I	Maxillary				
O15		366	ULC	11	canine	C	Maxillary	Left			

Sq.		Find	Code	Number	Type	Tooth	Position	Side	Age Estimation	Source	Notes
N14		368			incisor	DI					deciduous
N14		368			molar	2nd M	Mandibular				
N14		368			premolar	PM	Mandibular				
N16		371			incisor	1st I	Maxillary	Left?			
N16		371	2ULM	15	molar	2nd M	Maxillary	Left	35-45	Brothwell 1963	
N16		371	2LRM	31	molar	2nd M	Mandibular	Right	25	Brothwell 1963	
N16		371	2URPM	4	premolar	2nd PM	Maxillary	Right			
N16		371	1LRM	30	molar	1st M	Mandibular	Left	25-35	Brothwell 1963	
N16		371	1URI	8	incisor	1st I	Maxillary	Right			
P12		374	1LLM	19	molar	1st M	Mandibular	Left	17-25	Brothwell 1963	
P12		374	1URPM	5	premolar	1st PM	Maxillary	Right			By root
K19		378	ULC	11	canine	C	Maxillary	Left			
K19		378	1ULM	14	molar	1st M	Maxillary	left	17-25	Brothwell 1963	In testing
K19		378	1URM	3	molar	1st M	Maxillary	right	17-25	Brothwell 1963	
K19		378	1ULM	14	molar	1st M	Maxillary	Left	17-25	Brothwell 1963	
K19		378	2URM	2	molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	
K19		378			premolar	PM	Maxillary	Right			
K19		378			premolar	PM	Maxillary	Left			
L8		382	2URM	2	molar	2nd M	Maxillary	Right	17-25	Brothwell 1963	

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