

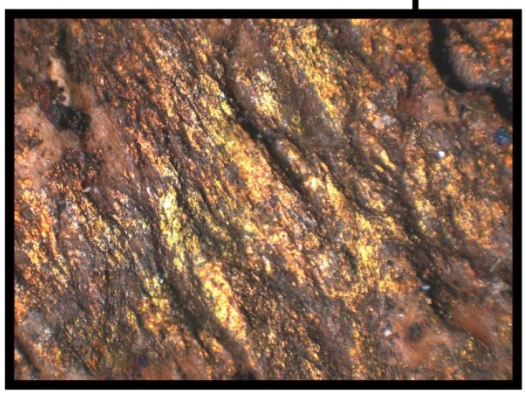

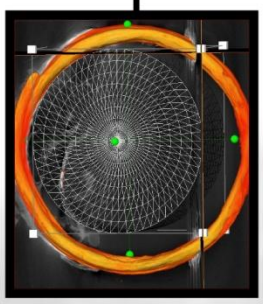



(IN)VISIBLY CROWNED?

RESEARCH ON "MAIDEN CROWNS": THEIR PRESENCE AND ARCHAEOLOGICAL VISIBILITY IN GRAVES FROM PLECHELMUSPLEIN, OLDENZAAL

E. EDENS

Picture cover: background is individual with find number 2009 from this study. Inset up-left is a glass fragment documented for the individual with find number 3087; inset down-left is a photo of sulphites observed on the endocranial surface of the individual with find number 6786. Both of these insets were taken using a microscope, with thanks to Hans Huisman. Inset right is a maiden crown excavated in Oldendorf (retrieved from http://www.spiegel.de/wissenschaft/mensch/ ausgrabungen-niedersachsen-totenkronen-schmueckten-jungfrauen-schaedel-a-953892.html). Inset down is a copper ring documented for the individual with find number 5830; image is a scan from the microCT (thanks to TU Delft and Hans Huisman). Adjusted and designed by the author.

Picture footer: Leonic flowers excavated in Stadtroda (retrieved from: http://stadtroda.otz.de/web/lokal/leben/detail/-/specific/Hinweis-auf-Totenhochzeit-in-Heilig-Kreuz-Kirche-Stadtroda-1689949010). Adjusted and designed by the author.

(In)Visibly Crowned?

Research on "maiden crowns": their presence and archaeological visibility in graves from Plechelmusplein, Oldenzaal

MA Thesis
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Her corpse shall be attended by maid's in fair array
Till the obsequies are ended, and she is wrapped in clay ...
A garland shall be framed by art and natural skill.
Of sundry-colour'd flowers, in token of goodwill
And sundry-colour'd ribbands in it I will bestow;
But chiefly black and yellow with her to the grave shall go

from an anonymous Elizabethan poem called "Corydon's Doleful Knell"
(Percy, 1812, p.2:292 cited in Morris, 2003, p.359)

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Table of Contents

1. Introduction to Oldenzaal & Maiden Crowns: what & why 11
1.1 History Oldenzaal & excavation 11
1.2 Research questions & research outline 16

2. Background information 21
2.1 Burial ritual Late Medieval-Post Medieval: general 21
2.2 Burial ritual Late Medieval-Post Medieval: funary headdresses 30
2.2.1 Archaeological data: examples 30
2.2.2 Historical data & literature on the funerary headdresses 48
2.2.3 Summary and archaeological visibility of funerary headdresses 56

3. Materials and methods 61
3.1 Selection process & start research 61
3.2 Physical anthropological methods 64
3.2.1 Administration & skeleton status 64
3.2.2 Dental analysis 65
3.2.3 Pathology analysis 65
3.2.4 Methods for sex assessment 66
3.2.5 Methods for age assessment 68
3.2.6 Estimation of ante-mortem stature 69
3.3 Methods for documenting the burial ritual 70
3.4 Methods for the chemical analysis 72
3.5 The database 73
3.5.1 Metadata: list of tables and their design 73
3.5.2 Metadata: queries & methods 77

4. Results 81
4.1 Results physical anthropological research: population under study 81
4.1.1 Males 82
4.1.2 Females 83
4.1.3 Young adults and sub-adults 85
4.1.4 Indeterminable individuals 87
4.1.5 Individuals with 'crown numbers' 88
4.1.6 Summary and overview 89

4.2 Results material analysis 92
4.2.1 Skull 92
4.2.2. Torso and shoulder girdle 124
4.2.3 Upper limbs 130
4.2.4 Hands 138
4.2.5 Pelvic girdle 140
4.2.6 Lower limbs 146
4.2.7 Finds without skeletal category 152
4.2.8 Individuals with no finds and exceptions 153
4.2.9 Analysis of funerary headdresses and related finds 154
4.3 Results chemical analysis: XRF 159

5. Discussion **161**
5.1 Identification of funerary headdresses & other objects in Oldenzaal 161
5.1.1 Archaeological definition of a funerary headdress 161
5.1.2 Individuals with (possible) crowns 194
5.1.3 Individuals with no funerary headdresses 210
5.2 Discussion funerary headdresses in Oldenzaal 216
5.2.1 Interpretation results: sex/age/time period 216
5.2.2 Findings Oldenzaal compared to known archaeological data 240
5.2.3 Archaeological visibility of the funerary headdresses 248

6. Conclusions and future recommendations **255**
6.1 Summary & conclusions of this study 255
6.2 Recommendations (further) analyses on funerary headdresses 264

Bibliography **269**

List of tables & figures **278**

Appendixes **289**
Appendix I: Catalogue Physical Anthropological Reports 293

1. Introduction to Oldenzaal & Maiden Crowns: what & why

Oldenzaal, a city in the province of Overijssel and in the region of Twente, has gained attention in the past few years because of recent archaeological research. In 2011 and 2012 both ADC ArcheoProjecten as well as RAAP (both Dutch commercial archaeological companies) excavated the Plechelmusplein in Oldenzaal (fig. 1.1); it was a large scale archaeological excavation of the cemetery that belonged to the Plechelmus church. The focus of this research is on a funerary ritual: the so-called 'maiden crowns'. This study will describe the 'maiden crowns' and associated finds in association with the human skeletal remains. This short introduction will provide some (historical) background on the city of Oldenzaal and these so-called 'maiden crowns'.

1.1 History Oldenzaal & excavation

The history of Oldenzaal is broader than only its existence as one of the hanseatic cities, but most data are known from this period; there are, however, also quite some data on the medieval period. Moreover, there are also finds that date to the early Iron Age (Williams, 2013, p.3) but these are scarce. The 'earliest' mentions in written resources appear to be from the 8th century (Oude Rengerink, 2011, p.14). From the Middle Ages to the 19th century, the history of Oldenzaal can be divided up in 7 phases, which is based on data gained from various archaeological excavations conducted in Oldenzaal (Oude Rengerink, 2011, p.16):

- The first phase pre-dates **750 AD**. It is a pre-Frankish settlement, of which unfortunately there are not much data. Only a few fragments of pottery from this period indicate activity and/or a settlement in this period, which is probably a Merovingian settlement.
- The second phase is around **750-950 AD**. Oldenzaal is a Frankish settlement in Carolingian times. A church was probably built from wood or stone, with Christian burials. The settlement would be near/around the church.
- The third phase, **950-1050 AD**, is characterised by the start of the first structure known as the Plechelmus church. This phase is also characterised by the start of the cemetery around the Plechelmus church. The settlement Oldenzaal becomes a religious and a administration center (Ottonian period).
- The fourth phase is around **1050-1250 AD**. The Plechelmus church is built in this period, in Romanesque architecture (12th century), which is still the present church. The cemetery is expanded in this period, but also expansions and renovation of the church happen in this period.
- In the fifth period, **1250-1625 AD**, there is a continuous function of the church.
- The sixth period is around **1625-1825 AD** and is characterised by the overtake of the

Protestant Reformation. Because of this, the central Catholic function is gone. In **1810**, the Catholics regain their church again.

- During the last phase, from **1829**, the cemetery is no longer in use. In **1899** several renovations took place and the area around the church was paved and became the Plechelmusplein. Recently, the Plechelmusplein has been renovated (see below) and the church is one of the 'rijksmonumenten': a national heritage site.

The archaeological research history of Oldenzaal appears to be very short, resulting in a lack of data on the earlier settlements (see: Nationale Onderzoeksagenda Archeologie (NOaA), chapter 20 (Groenewoudt, Groothedde and van der Velde, 2006)). Therefore, one of the research themes/questions from the NOaA is to gain more data on the development of Oldenzaal as a settlement and city (NOaA 1.0).



Figure 1.1: topographical map of Oldenzaal, with the excavation area of the Plechelmusplein outlined in red. (Oude Rengerink, 2011, p.60)

The excavation of the Plechelmusplein

The reason for the excavation conducted in 2011 and 2012 was the renovation of the Plechelmusplein. In total, approximately 5000m^2 was excavated, which resulted in 2750 excavated human skeletons (Williams, 2013). During the excavation, basic physical anthropological data like sex and age of the individual were gathered. Using the most recent data (from the evaluation reportage 2013), there are in total 2229 adults (556 males, 724 females and 949 indeterminable) 189 juveniles, 291 children and 41 indeterminable individuals. Physical anthropological analysis was conducted on 200 of the 2750 excavated individuals; the final age and sex estimations may differ from the aforementioned numbers. In accordance with the statement of requirements (Programma van Eisen (PvE)) only primary burials were documented. Of these 2750 individuals, DNA and isotopic samples were collected from 1005 individuals. Most of the individuals were buried on their back, with a head west and feet east orientation. There were some exceptions, as 9 burials seem to be north-south orientated. However, most of the burials were 'normal' Christian burials (i.e. coffin burials) (Williams, 2016). From calibrated data (^{14}C) the oldest burial was dated to 615-745 AD, and from historical data the youngest burial was from 1825 AD. The reportage was, however, still in progress when this study was conducted; for final conclusions regarding the excavation the reader is referred to Williams (2016).

This study will focus only on a selection of graves from the Plechelmusplein. During the excavation, 'green residue' or 'green stains' were found on some skeletal regions of individuals. This green residue was found on different body locations of in total 127 individuals. The most frequent location was the head (77%) but other parts include the thoracic region and the pelvis (6%), the limbs (5%) and hand/foot (3-4%). The majority of these burials were from the 17th - 19th century; at least from 1500 AD or later. The green residue/discoloration is the result of copper material that was laid on the individual as part of the burial ritual, or was a component of certain objects which were worn and with which the individual was buried. This can be from parts of clothing (e.g. belt buckles) or jewellery (e.g. hair pins). With some individuals, the copper staining came from fragments of copper wire which was placed on or around the skull, as observed during the excavation. These copper wires resemble previously documented 'Leonic wires' in English or 'leonische Drähte' in Germany (Lippok, 2011; Nooijen, 2013, p.40). According to Lippok (2011), the presence of these specific Leonic wires, fabricated in Lyon and with a specific chemical composition, are related to and associated with the phenomenon 'maiden crowns' or 'maiden garlands'; a term used to describe these 'crowns' or specific decorative wreaths that were given to the deceased (Morris, 2011, p.272).

There are some other examples with a similar decoration known from archaeological context (e.g. Portegies, 1999, p.98; Sam *et al.*, 2005, p.74) and the meaning, concept and construction of such a 'crown' has been researched – though only fragmentary. Frequently, the appearance is described as a metal frame decorated with organic material (e.g. leaves, flowers). The general accepted theory for these decorations is that 'maidens' were buried with these (Morris, 2011, p.272); which would mean that only unmarried females would receive such a burial ritual. Also, besides the social-cultural research on this burial ritual, a much more technical research on this burial custom has been conducted on material from Germany (Lippok, 2013), but not yet on material elsewhere.

The individuals (n=127) found with green residue provide a useful source of information to research this specific type of burial ritual. However, because of fragmentary research, additional data are needed to establish a better general idea of this burial custom. For some of these 'crown' individuals (n=15) from the Plechelmusplein the presence of this burial custom was certain; this was based on finds and discoloration on the skull. However, for the remaining individuals(n=112) the presence of this burial custom could not be definitely established. As the most frequent skeletal location documented with green discoloration was the skull, this did suggest that these individuals were possibly also buried with a similar decoration. In addition, the possibility that other types of headgear containing copper elements were present should not be excluded; if possible, they need to be differentiated from the burial custom under study. It appears that the visibility of this burial custom varies in archaeological context, which makes the identification of this burial custom and related research difficult. Therefore, analyses on the archaeological visibility, the definition and identification, and also to some extend the social-cultural and chemical aspects, are needed to create a more complete dataset on this burial custom. As for chemical data; during the excavation a chemical analysis was already conducted on the copper fragments documented with the previously mentioned 15 individuals. It would be an addition if further chemical testing could be done on human bone and other finds in order to gain more insight on the chemical composition of the metal decorations. It may then also be possible to research to which extend these metal decorations can be identified based on chemical data and if they can be differentiated from other types of headgear and copper objects not related with this burial custom. Furthermore, these aforementioned analyses of these individuals and this specific type of burial ritual would be a huge addition to what is currently known on this burial custom, and would also provide with some very detailed information about this burial custom, especially for the Twente region, and moreover the Netherlands.

1.2 Research questions & research outline

Using these possibilities and the necessity to research this burial custom further, the goals of this study were established. It should be noted that the term 'maiden crowns' or even 'maiden garlands' are mentioned throughout different (archaeological and historical) sources for this burial custom. As similar (metal) decorations can be present but do not represent a crown, a more general term is needed to cover all types of decorations associated with this burial custom. For this study, the term 'funerary headdresses' is used to cover these different types; these will be further explained in the next chapter.

The main goal of this study is to analyse and research the identification and related archaeological visibility of this burial custom in an archaeological burial context. The main research question formulated for this study is: 'what is the archaeological visibility of the burial ritual using funerary headdresses and how can this burial ritual be identified in archaeological context?' The previously mentioned selection of human skeletal material from Oldenzaal will be used; in this selection are those individuals for which it is certain this burial custom was present (n=15), and a selection of individuals for which this is not completely certain (n=33). The complete set (n=112) was not taken due to various reasons which will be explained in paragraph 3.1.

To answer the main research question, several sets of data need to be gained from this selection. These are data from different aspects; the physical anthropological research (1), the inventory and analysis of the grave goods or other finds (2), and the chemical analysis of the green discoloration on bone and other finds (3). Data on these aspects will provide a biological profile, inventory of the grave goods and therefore material compositions of the (possible) metal frame, and chemical compositions of the (possible related) metal decorations.

The data on the individuals of which the presence of this burial custom was definitely established will be used to create an archaeological definition of this burial custom in the form of several criteria (4). When the 'uncertain' individuals in the selection under study are possibly/probably identified with these aid of these criteria, the chemical data and biological data will be combined with presence/absence of this burial custom in order to gain insight into possible differences and the archaeological visibility of this burial custom (4). Additionally, an analysis of this burial custom occurring in historical data and archaeological data will be conducted (4) to compare the findings of Oldenzaal with previously gained data on this burial custom from Europe; specifically the Netherlands.

1) Physical anthropological research

The physical anthropological research provides data on aspects such as sex, age and remarks about pathology[1]. It provides this research with a solid base; the biological profile of the individuals which were (probably) buried with this burial custom. With this solid base the next part of this research can be performed, i.e. the analysis of the burial custom itself. Sub-research questions for this aspect include:

a. What is the skeletal inventory of the individual?
b. What is the age assessment of the individual?
c. What is the sex assessment of the individual?
d. Are there any pathological remarks, and if so, what do these remarks indicate?
e. What is the general preservation/conservation of the individual?
f. What is the date of burial?

2) Inventory finds/material analysis

The second aspect is the inventory of any artefacts/finds on or with the buried individual. An analysis and documentation of these finds offers insight in how certain metal (copper) objects were placed within the grave, to determine which grave goods were present, and also the possible reconstruction of these decorations. This inventory does not only include grave goods; the locations and presence of green discoloration on bones are also documented. Another focus are the metal decorations; elements/fragments of either a metal frame and/or decoration(s). Their appearance, material category, and other remarks will be documented. Also, the finds that were observed and documented during the excavation were studied and documented by the ADC (Nooijen, 2016, pp.138-142) and will be combined with the material analysis of this study. In the end, a general overview of the grave goods, finds, and/or metal decorations (elements) will be given per skeletal region (see chapter 3). Sub-research questions for this analysis include:

a. What is the location, appearance, size of any green discoloration present on the bones?
b. What kind of other discoloration(s) and/or residue(s) is/are present on the bones? If so, what is the location/appearance/size?
c. What kind of objects/residue(s) is/are present in the soil residue?
d. Is it possible to correlate certain discoloration(s) and residue(s), and if so, what does this correlation suggest?
e. What is the appearance/location/size of the metal decorations or metal fragments?

[1] Usually, physical anthropological research is performed on a larger sample (>200 individuals) and with the data gained from these individuals a population research can be conducted (distribution of age, sex, pathological remarks, comparison with other populations). Because the sample size for this research is too small, and the fact that the sample was merely selected on the presence of green discoloration and fragments of the metal decoration(s), this could not be conducted in this study.

f. What is the general overview of the grave goods, findings and/or metal (elements) buried with the individual?

3) Chemical analysis

The third aspect, in relation to the second, is the chemical analysis of the green discoloration and certain finds; a similar research conducted by Lippok (2013) for decorations associated with this burial custom from Germany. All of the selected individuals in this study had green discoloration present on the bones which will be chemically analysed – and if possible, also their counterparts (the metal fragments, and/or other copper objects). The chemical analysis is only an aspect of this burial ritual analysis, but it is the most important one. With the results of the chemical analysis, a general idea of what these decorations and other finds related to this burial custom consisted of can be formed. As Lippok (2011) associates the presence of Leonic wires with the presence of this burial custom, this study will research to what extend it may be possible to identify these Leonic wires based on the chemical composition. Though it should not be excluded that different types of wires were used in this burial custom, the chemical analysis will also allow researching the possibility that Leonic wires were present and to what extend these specific wires are associated with this burial custom. The question whether or not chemical analysis can contribute to and/or aid in identifying this burial custom is the main research question for this aspect. Another focus of this chemical analysis is to research the possibility to make a correlation between the metal decorations and the residue they have left on the bone using chemical data. The chemical analysis of green discoloration on the bones will also allow indicating if there are specific objects, based on their chemical composition, placed at certain locations on the individual. Therefore, these sub-research questions were established:

a. What is the chemical composition of the documented green discoloration?
b. What is the chemical composition of any other documented discoloration(s)/object(s)/residue(s)?
c. What is the chemical composition of the documented metal decorations/metal elements? What kind of specific elements are present which may aid in chemically identifying this burial custom?
d. What is the chemical correlation between the green discoloration and its counterpart (i.e. the metal decorations/metal elements – if this was possible to reconstruct)?
e. What is the chemical correlation between object(s)/discoloration(s) and certain location(s)/pattern(s)/skeletal region(s)?
f. How can the chemical data aid in distinguishing certain objects?

4) Comparison of findings

The last aspect is to combine data from the previous aspects with general data on this burial custom. These general data will be gained from both archaeological examples of this burial custom (regions of the Netherlands and Europe in general) and from historical sources (only the region of the Netherlands). These data will give an indication to which objects and decorations can be archaeologically expected for this burial custom, as well as possible regional/local differences; therefore also providing the possibility to research and discuss the general archaeological visibility of the decorations associated with this burial custom. In addition, with the data gained from the previously mentioned aspects, further analyses on presence/absence of this burial custom and biological data as well as a comparison of this burial custom are possible. Besides using these data to answer the main research question, this will also allow a more detailed insight on some aspects of this burial custom (e.g. age of the individual) and place the results of this study in a larger context. For the latter, both the archaeological examples from the Netherlands as well as the results of this study will be compared with archaeological examples from Europe; it may indicate similarities or differentiation in this burial custom between countries or regions. The sub-research questions are as follows:

a. What is currently known from archaeological data on this burial custom? What is the available data on location/time period/type of this burial custom as well as decorations?
b. What data do Dutch historical sources provide on this burial custom, such as time period, decorations, conducting the ritual, and possible local variation?
c. Based on archaeological and historical data on this burial custom, what is the definition of this burial custom? What is their appearance (decorations)?
d. Based on data from the physical anthropological analysis, the finds analysis, and the chemical analysis, what is the definition of this burial custom for this study?
e. What is the general appearance of these decorations associated with this burial custom?
f. Which decorations can be generally expected in archaeological context and which decorations will be archaeologically invisible? Are local/regional variations in this burial custom present and if so, what are these variations?
g. Based on data from this study, can any social-cultural differences be observed? If so, what are these differences?
h. When results of this study are compared to other archaeological/historical examples of this burial custom, are there any similarities/differences between decoration/construction of this burial custom present?

The burial custom(s) from this time period is/are far more detailed that presented in this chapter; the next chapter will therefore provide background data. Both archaeological and

historical data on this specific burial custom will be presented. In addition, as grave goods are generally substantial (the aforementioned objects from clothing or jewellery) in this time period (18th - 19th century), general copper (alloy) objects used in this time period are also shortly presented so they can be differentiated from the burial custom under study.

2. Background information

In this chapter, background information regarding the late medieval and post-medieval burial customs and specifically the burial custom under study will be presented. An overview on the commonly used copper (alloy) objects in the late medieval and post-medieval time period will be presented, as well as specific details on objects used in funerary headdresses. Both examples of funerary headdresses from archaeological context as well as from historical sources will also be presented to provide an overview on the current state of knowledge and research on this burial custom.

2.1 Burial ritual Late Medieval-Post Medieval: general

As mentioned in the previous chapter, this study will focus on a specific burial custom. The analysis of green discoloration on human skeletal material is an aspect of this study. However, to be able to differentiate between 'normal' used copper alloy objects (e.g. pins) and specific copper alloy objects (e.g. Leonic wires) which are associated with funerary headdresses, an overview of common copper alloy objects in the late medieval and especially post-medieval burial customs is needed, as well as an overview of expected material with a funerary headdress.

However, the archaeology of death in the post-medieval era is, according to Tarlow (2015, p.7), not a well-researched aspect. This makes research on burial customs from this time period difficult. Though not extensively researched, it is, however, known that there are quite some changes in burial customs from this era in comparison with the medieval burial customs (Bitter, Bonenkampová and Goudriaan, 2013, p.11; Kenzler, 2015; Tarlow, 2015). The absence or decrease of grave goods (Gilchrist, 2008, p.122) and lack of diversity in burial position for burials from the medieval period, especially early medieval and Middle Ages, are very likely correlated with the increase of Christianity (Bitter, Bonenkampová and Goudriaan, 2013, p.11). Though a change of burial custom has been reported in the late medieval period, this change is more visible in the post-medieval period (Tagesson, 2015, p.19; Tarlow, 2015, p.8). The post-medieval period is a time of complex and multiple beliefs about the dead body and what happens after someone dies (Gordon and Marshall, 2000, p.8; Tarlow, 2015, p.8), which is represented in burial customs from this period. In addition, it is often assumed that the Reformation, which changed religion and doctrine in general, was of great importance in the change of rituals and customs (Marshall, 2002; Curvers, 2010, p.3; Tarlow, 2015, p.7). Though Curvers (2010, p.51) concludes that in the period after the Reformation no drastic changes related to the Reformation are present in the burial customs, some small changes do occur. This is especially

true for the presence of grave goods. Along with grave goods in general, the number of metal/copper alloy objects in burial context increases.

The general trend, and therefore a change, that is visible from the medieval times to the late medieval/post-medieval period, is a more emotional and individualized pattern in burial customs (Tarlow, 2015, p.7). This is often referred to as 'beautification of death', which includes a huge amount of preparation for the deceased; special clothing (grave clothing), accessories, and certain flowers to decorate and/or mask unpleasant odours were common aspects of this beautification (Nyberg, 2010, pp. 17-18; Tarlow, 2015, p.7). This transition in burial custom is visible as graves from the post-medieval times are filled with more personal belongings; aside from the beautification, grave goods and burial are used as a 'social medium' (Tagesson, 2015, p.19). Though Tarlow (2015) reports a continuous trend of scarce grave goods in the United Kingdom, even for the later periods, the archaeological data from the rest of Europe indicate an increase in grave goods; both daily objects or personal belongings (e.g. jewellery, pipes) and spiritual items (e.g. rosary). Furthermore, the deceased is often dressed in 'normal' or 'daily' clothing (Bitter, 2002, p.237; Sam *et al.*, 2005, pp.66-67; Tagesson, 2015, p.28). Elements of a copper alloy are frequently found in clothing, so it is of importance to understand the variety of metal and copper alloy objects that are an aspect of clothing for this time period. Cox (1996) describes various dress-accessories from a post-medieval site in Scotland; this inventory provides a general idea of the expected metal/copper alloy objects on clothing from this period. According to Cox (1996), the most common objects of copper alloy are pins (fig. 2.1). These are often used to secure specific clothing, but in burial context pins are also used to secure shrouds. These shroud pins are frequently encountered in the area of the head; which may result in green discoloration on the skull (Powers and Miles, 2011, p.237). Other frequently used objects on clothing are buttons (fig. 2.2), lace tags (fig. 2.3), wire rings/eyelets (fig. 2.4), and sometimes cufflinks (fig. 2.5). Wire rings/eyelets and buttons are also objects to secure clothing; though sometimes a coat chain is also present (fig. 2.6) (de Groote *et al.*, 2011, p.149). Lace tags are used for shoes (at the end of the laces) but are also found on clothing (Cox, 1996, p.56).



Figure 2.1: pins found in many graves from the Carmelite convent in Aalst (de Groote *et al.*, 2011, p.146).

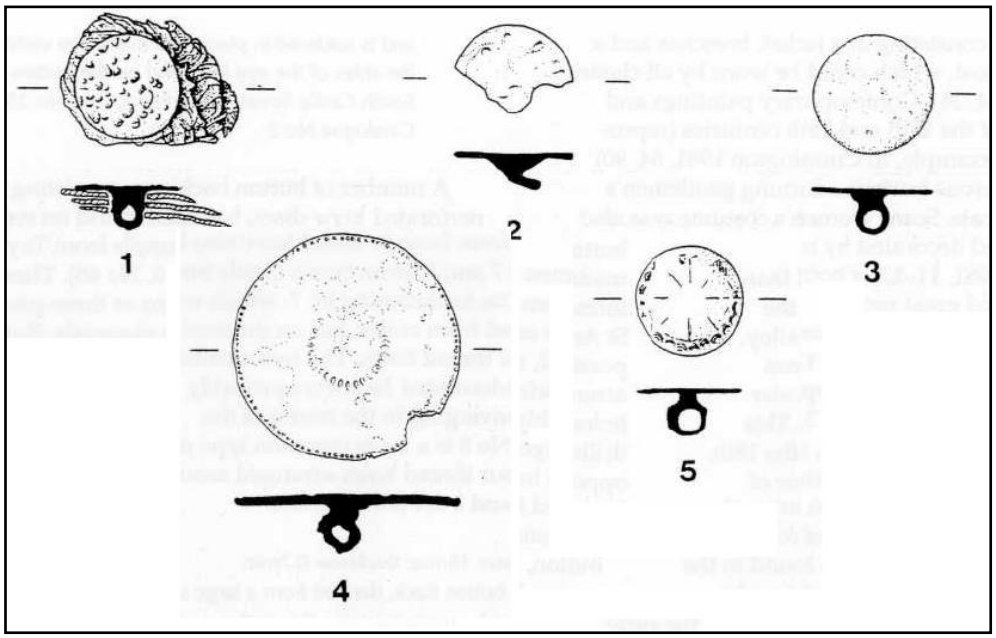

Figure 2.2: buttons excavated from various sites in Scotland (Cox, 1996, p.53).

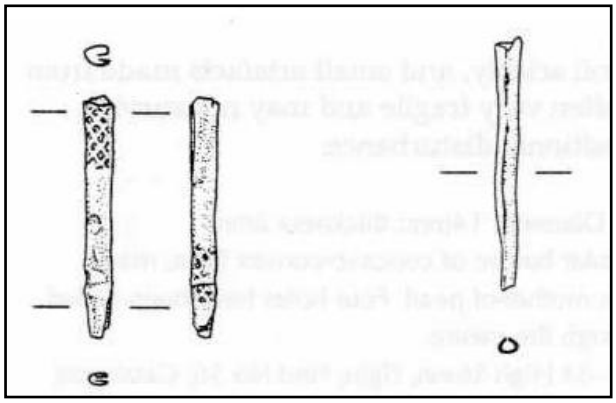

Figure 2.3: lace tags excavated from various sites in Scotland (Cox, 1996, p.55).



Figure 2.4: wire rings and eyelets found in many graves from the Carmelite convent in Aalst (de Groote *et al.*, 2011, p.148).

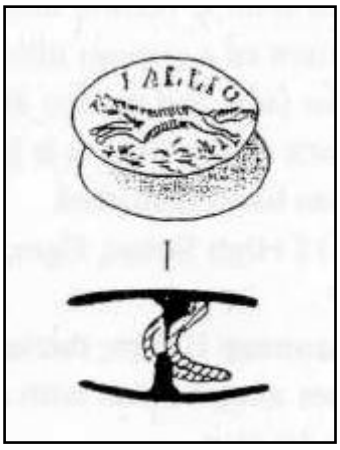

Figure 2.5: cuff link found in Paisley, Scotland (Cox, 1996, p.53).



Figure 2.6: coat chain found in a grave from the Carmelite convent in Aalst (de Groote *et al.*, 2011, p.149)

All of these objects were also found in Dutch post-medieval sites (e.g. Sam *et al.*, 2005; Arts, 2013; Williams, 2013) as well as Belgian sites (e.g. Steel, 2007; de Groote *et al.*, 2011); for the latter belt buckles were also documented. Additional copper alloy objects frequently documented in post-medieval burial context are (Derks, Van Kerckhove and Baetsen, 2008); rosaries, coins, and sometimes a ring (also reported in Belgian sites (Steel, 2007). Especially in Catholic areas, rosaries are frequently found in graves from this period (Derks, Van Kerckhove and Baetsen, 2008; Powers and Miles, 2011, p.238; Arts, 2013). A rosary, often made from bronze material, is placed around the folded hands in prayer of the deceased (Kenzler, 2015, p.159). Powers and Miles (2011, p.238) report finds such as crosses and chains as well.

Textile residue was found in a grave at the site of Oosterhout (Sam *et al.*, 2005); this was in combination with a copper alloy object. Further analysis indicated that these finds may have been from a corsage on either the clothing or a hat; the textile residue was preserved because of the presence of copper. This burial custom in which individuals were buried with a hat was also found in graves from Elst, around the Grote Kerk (Derks, Van Kerckhove and Baetsen, 2008). Finds at this site were fragments of brass wire and a glass bead, which was, according to the authors, part of a shroud. Furthermore, for a few individuals there was a significant amount of green discoloration on the skull. It was probably from brass wire and pins, which were possibly items from headgear worn by the deceased. One individual had metal residue around the skull; these were probably also the remnants from headgear. These graves were from the 17th century, some from the 18th-19th century, and it appears that it was customary to bury the deceased with a type of headgear, which sometimes contained metal or copper alloy object(s). In Germany, a similar burial custom is present. Lippok (2011) reports the usage of caps (*Haube*) in burial customs, and as these caps frequently included copper (alloy) or metal, residue may still be present around or near the skull. According to Lippok (2011) these caps were found on both sexes.

A combination of copper alloy objects and textile, purposely combined, was found in Aalst, Belgium (de Groote *et al.*, 2011). Fragments of braided textile intertwined with metal threads were discovered in two graves, probably from the 17th century. It was a combination of silk threads and copper threads (fig. 2.7).



Figure 2.7: fragment of braided textile intertwined with copper threads, found in grave 1412 from the Carmelite convent in Aalst (de Groote *et al.*, 2011, p.156)

Other copper alloy objects frequently encountered in burial context from this period are, as previously mentioned, coins. Though these coins are often among the grave goods in context of a small purse (Arts, 2013; Williams, 2013), they are also frequently found in the mouth of the deceased (Hopkinson, Yeats and Scott, 2008; Arts, 2013). The coins with a copper alloy will leave a green discoloration in the area of the mouth; Hopkinson, Yeats and Scott (2008) recorded green discoloration in the areas of the mandible (fig. 2.8) and maxilla, teeth, and sometimes even the hyoid. However, in some occasions these coins were placed under the head or in the hands of the deceased (Arts, 2013, p.32).



Figure 2.8: green discoloration from a coin on the posterior aspect of the mandible of a child (Hopkinson, Yeats and Scott, 2008, p.13)

In addition, Tagesson (2015) describes the frequent presence of the so-called funeral coronets in burial context. These funeral coronets consist of wreaths and flowers, combined with copper threads and glass beads. Tagesson (2015) mentions that from funeral coronets in later periods, it is known that these wreaths were given to unmarried girls in the tradition of the 'Brides of Christ'. Comparisons are drawn with other examples in Europe, where this burial custom is often known as 'maiden crowns', as shortly explained in the introduction chapter. Examples of these funerary headdresses, as well as its historical definition will be presented in the next paragraph, as this study will focus on the presence of these funerary headdresses in burial context from the Plechelmusplein site.

The aforementioned 'normal' metal/copper alloyed objects that can be expected in burials from the late medieval and especially post-medieval period, and their probable location on the individual, are presented in table 2.1 to provide an overview. The objects associated with a funerary headdress are excluded; they will be discussed in the subsequent paragraph.

Table 2.1: copper alloy objects found in post-medieval burials and their corresponding possible location on the deceased.

Copper alloy object	Possible location
Jewellery, see below	various locations, see below
> bracelets/rings	> hands/fingers
> necklace	> neck area
> earrings	> skull
Pins	various locations; concentrated
Buttons	various locations; arms/legs/thorax
Lace tags	mostly feet
Wire rings/eyelets	thorax/arms
Cufflinks	hands
Rosaries	hands/pelvis
Coins	near individual/hands/mouth area
Headgear/cap	skull

2.2 Burial ritual Late Medieval-Post Medieval: funary headdresses

As mentioned in the previous paragraph and shortly in the introduction chapter, a specific burial custom in which mainly copper alloy objects are used, are the so-called 'maiden crowns' or 'funeral coronets' (Tagesson, 2015); sometimes even named 'maiden's garlands' or 'virgins' crowns' (Morris, 2011, p.271), but referred to as 'funerary headdresses' in this study. Certain grave goods, in particular a metal frame or wreath, have been documented for this specific burial custom. In addition, the metal residues (i.e. copper alloy/iron) the decoration may have left on the skull as well as any organic residue are also frequently found. The goal of this section is to obtain a clear image of the definition (i.e. construction, decorations) of a funerary headdress, as well as what can be archaeologically expected when this specific burial custom is present in a grave. To do so, excavations and other archaeological data from different sites in Europe with similar finds regarding this burial custom will be described in the following paragraphs. Of course, deriving the definition of this burial custom based on only archaeological data results in an incomplete definition; in most cases any organic material which was buried with the individual is lost due to taphonomic processes. Therefore, historical data and a more recent example of this burial custom are described and analysed, in the attempt to gain more information about the aspects of this burial custom that may not be visible in archaeological context. In addition, based on historical data and previous research, the terminology and the symbolic meaning of this burial custom will be shortly discussed.

2.2.1 Archaeological data: examples

Archaeological examples of this burial custom are presented in this paragraph; this will give insight into the most common finds in the archaeological record. Examples from the Netherlands are presented first because of the material under study, and also presented in chronological order per site; examples from Europe are presented afterwards.

Archaeological examples from the Netherlands

Waalse Kerk in Haarlem (NL) (Groen-Houchin, 2013)

In the report of Groen-Houchin (2013), a botanical sample from an inhumation is described and analysed. The corresponding inhumation was found during an excavation on the cemetery of the Donkere Begijnhof in Haarlem, which is north of the Waalse Kerk. The botanical sample included organic material and there was some green discoloration - copper residue - present. All of this was present on the skull of this individual. Carbon dating of bone indicated that the area of the cemetery in which this individual was buried, was in use around 1430-1480 AD; making this possibly the oldest example. Physical anthropological research indicated that the individual was female, and age-at-death was established between 37-46 years. The copper residue was,

however, not only present on the skull; it was also visible on the mandible, the atlas and the upper arms. The botanical sample was used for palynological and botanical analysis, of which the first provided no result due to poor conservation. The botanical research yielded one taxa, of which approximately 30 fragments were present (fig. 2.9 illustrates one fragment). The determination of this taxa was *Rosmarinus officinalis* L., or rosemary. There is no mention of any metal finds, like copper or iron wire; only the copper residue with rosemary leaves on the skull were documented. However, this individual was apparently not the only one with copper residue; this was documented on 22 skulls and 6 mandibles. However, in the archaeological report of this excavation (de Groot, 2014, p.66) it is mentioned that this residue, sometimes present as distinct circles or otherwise vague impressions, is both found in females and males. Though some of this residue might be the result of pins from clothing, this was not always the case, as for example with the aforementioned individual. No definite conclusions were made in regards to the presence of a funerary headdress; though Groen-Houchin (2013, p.16) points to the possibility, among others, of a wreath containing rosemary. Her short discussion on the construction and decoration of a funerary headdress (based on some historical data) points to the usage of rosemary in these crowns and, according to the author, therefore indicating that this find from the Haarlem site may also be an aspect of this specific burial custom.



Figure 2.9: fragment with copper residue and organic material (Groen-Houchin, 2013, p.4).

St Jansbasiliek on the Markt in Oosterhout (NL)

In the spring of 2003 an archaeological excavation took place in the center of the city Oosterhout (Sam *et al.*, 2005). Reason for this excavation was construction work; the excavation took place prior to this. Aside from indications that a settlement dating from the 8th – 11th century was present on that location, there were also inhumations excavated. A total of 400 graves were excavated, most of which dated to the 13th – 19th century. According to the authors, most of the finds and burials indicate a 'typical' late medieval/post-medieval cemetery, though there were some exceptions. During this excavation several individuals – three complete individuals and two skulls – also had certain objects in their grave that indicated the presence of a funerary headdress (Sam *et al.*, 2005, pp. 73-75). The authors mention that this ritual, and this type of burial goods, is known and also found at other sites. It appears that with these individuals, organic material in combination with copper wire were present and well preserved. Classification of the organic material, which were leaves, indicated that these were from *Buxus Sempervirens* (Sam *et al.*, 2005, p.74) which is also known as Common Box or European Box. Figure 2.10 illustrates these leaves found in the grave (on the right) and the residue (organic and metal) found on the skull during the excavation. Physical anthropological research indicated that the three complete individuals were two women and one small child. The sex and age of the two skulls is unknown.



Figure 2.10: decoration and the residue on a skull (Sam *et al.*, 2005, p.74).

St. Janskerk in 's-Hertogenbosch (NL) (Portegies, 1999)

Portegies (1999) reports a similar burial custom found in graves in the St. Janskerk, from the 17th - 19th century, based on both archaeological and historical data from Den Bosch. According to Portegies (1999), historical data indicate that Catholic children, especially very young children, were buried with funeral wreaths. These wreaths would mostly consist of flowers; these were either real flowers or ones made of paper. Portegies also describes that in Den Bosch, around 1875, the wreaths also consist of white small roses. These wreaths were placed around the head as a crown, or as an arc over the head, or near the shoulders. The deceased was placed, with folded hands, in the coffin with these decorations. In addition, young children were laid on pillows of cotton, and were furthermore decorated with anything that was reflective. Often slivers of tinfoil or gold-like paper were used, but slivers of pewter spoons or fragments of glass in a variation of colours were also used to reflect light and decorate the deceased. However, flowers were not the only organic decoration used in this burial custom. Portegies mentions that according to minister Hanewinkel, in 1799, green herbs were also used to decorate the deceased; mostly near the area of the head. Though the burial custom appears in the 18th and 19th century, the usage of these funeral wreaths as crowns appears also in the 17th century. However, in this period of time, the usage of these crowns was only permitted when the family of the deceased paid an extra amount of money to the church. Later, these crowns could be 'rented'. Furthermore, Portegies mentions that crowns would be placed on top of the coffin when the coffin was closed (1999, p.98), instead of around/near the deceased. Even though most of the description Portegies provides derives from historical data, archaeological data from graves in the St. Janskerk do correspond with this on some aspects such as the decorations (Portegies, 1999).

Mariakerk in Didam (NL) (Schabbink, 2013)

Another example of this burial custom in the Netherlands was found in Didam, in the municipality of Montferland. Archaeological research conducted around the Maria church in Didam – conducted because of the installation of a sewer – revealed 36 burials (inhumations). In one of the burials, grave 35, the finds indicated the presence of a funerary headdress. The individual buried in grave 35 was a young (probable) female, as age estimation based on dental eruption and mineralization placed the individual in the age range of 14-16 years and sexualization degree of the cranium scored -1,67 (with a total of weighted factors of 24) (Baetsen, 2013, pp. 26-27). It should be noted that due to the young age of the individual, the sex estimation cannot be definitely concluded. The most remarkable finds were the metal fragments consisting of copper and decorated with organic material (textile), which were found around the skull of the individual. The metal decorations consisted of curled and braided copper wire to form various flowers and leaves, some were even of iron wire (figure 2.11).



Figure 2.11: decoration and the residue (textile) on the skull (Schabbink, 2013, p.35).

Other material which was found in the crown were glass beads, sequins, and textile, of which the latter was probably a cap-like element covering the head of the individual and attached to the metal decorations. Some paper was also entwined with the metal decorations. Because the skull was intact and most of the material preserved, the reconstruction done by Restaura illustrates this funerary headdress as it probably originally was (fig. 2.12). The author compares the funerary headdress, and the material attached to it, to mourning jewellery from the 18th – 20th century. Comparing the shape, construction, and used material with finds from Germany (see other funerary headdress examples from Europe), this funerary headdress consist of Leonic wires and so-called Leonic flowers. The individual was probably buried in the late 18th or in the 19th century.



Figure 2.12: reconstruction of the decoration on the skull (Schabbink, 2013, p.37).

Papenhoven, Sittard (NL) (Panhuysen, 2004)

During construction work on the cemetery of Papenhoven, Sittard (province of Limburg) three burial tombs were exposed from the 19th and 20th century. In two of those burial tombs a coffin was still present, and one of these coffins contained an individual with similar decorations of a funerary headdress. The individual was, as far as morphological features could be analysed (the bones were not taken out of the coffin), a male with an age-at-death between 44.3 and 55.7 years. Most of the clothing on the arms was not preserved well; the textile fragments on the lower body were, however, very well preserved. The clothing suggested some sort of long coat or suit (fig. 2.13). Fragments of metal formed some sort of crown around the skull of this individual. At the location of the hands, a rosary was also found.



Figure 2.13: field photo of the individual found with a funerary headdress (Panhuysen, 2004, p.6).

Archaeological examples from Europe

Bosco Gurin, Switzerland: recent ritual (Venbrux, 1991)

This example indicates that even in modern times, this burial custom and 'marriage in death' (as named by Venbrux, 1991) is still present. This recent example of a funerary headdress was present in Bosco Gurin, a small village in Switzerland. In 1960, a young girl (18 years old) was buried as a bride. Venbrux (1991) was present there locally in 1985 and reports in his article the burial ritual based on what an informant had told him (Venbrux, 1991, p.193). He then also addresses the analogy between death and marriage, the concept of death-marriage and why specifically this young girl was buried with this type of burial ritual. These aspects of his research will be shortly analysed in paragraph 2.2.2, where all of the historical data on this ritual are described.

The local baker's daughter was very ill in January, 1960. She was 18 years of age, had cancer, and died in late January of that same year. All of the villagers attended the wake, as everyone knew the girl. The complete wake and mourning rituals before the burial were quite complex. Venbrux describes very detailed how the wake was attended, what rituals they performed, and the conducted rituals regarding the burial itself (1991, p.194). During this complex mourning ritual, older women had made decorations for the girl, which were wreaths that consisted of larch twigs and paper flowers. Right before the burial, as the young girl was completely dressed as a bride (she wore a wedding dress and the earlier mentioned decorations were present) the priest objected to the way the young girl was dressed. It appears the priest wanted to bury the young girl completely in black, but the villagers (especially the men) were convinced that the young girl should be buried as a bride. During the funeral mass, more wreaths were brought and placed on the coffin. On each corner of the coffin a candle was burning. She was then buried, still dressed in a wedding-dress and with the aforementioned wreaths, decorated with (paper) flowers and twigs.

Onze lievevrouwenkathedraal in Antwerpen and other Belgian sites

In Belgium, a sufficient amount of finds which indicate the presence of funerary headdresses were also found in burial context. These finds are, in contrast with the previous example of this burial custom, from archaeological excavations. In his overview of post-medieval mortuary practices in Antwerp, Veeckman (1997, p.73) describes a frequent occurring burial custom with similar decorations as described for the archaeological examples from the Netherlands. Excavations in the Cathedral of Our Lady (Onze lievevrouwenkathedraal) in Antwerp have yielded also a significant amount of archaeological examples of this burial custom, as well as excavations in the St. Paul's Church (Sint-Paulus kerk). Veeckman (1997) describes the finds as a 'crown' made of a metal frame, and this frame is decorated with flowers and leaves. However,

Veeckman (1997) also describes that often other material is used as well in this burial custom; fabric, paper, metal, and glass are also frequently found. A detailed overview of these funerary headdresses was made by Steel (2007), as she made a general inventory of the graves excavated in the Cathedral of Our Lady, and also a grave inventory of the St Paul's Church. For the Cathedral of Our Lady, 5 crypts included individuals buried with '*doodskroontjes*' (death crowns). As multiple individuals were buried in these crypts, multiple finds of these funerary headdresses were also present. The funerary headdresses were made of a copper frame and decorated with flowers and leaves. One specific funerary headdress is described; it is made of a copper-wire frame and decorated with green ribbon, white flowers, and green leaves. This construction was worn like a coronet. Other inventoried decorations with these funerary headdresses are fabric, and flowers and leaves, frequently made from paper and silk. Moreover, decorations like glass (splinters) (fig. 2.14 and 2.15) or beads were also found on the coronets. These glass splinters resemble the mentioned reflective decoration by Portegies (1999) for Brabant. For graves from the St Paul's Church, also 5 crypts contained individuals which were documented with a funerary headdress. The decorations of these funerary headdresses are similar to the ones found in the Cathedral of Our Lady.



Figure 2.14: small decorative ornaments of glass found with a funerary headdress in burial context (Veeckman and Bellens, 2013)

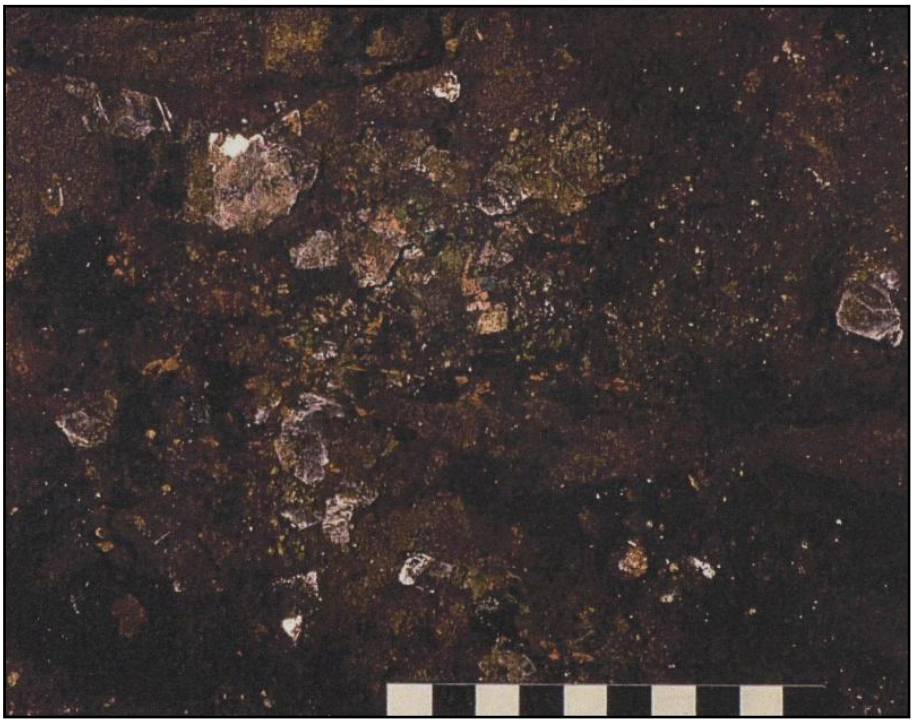

Figure 2.15: small fragments of glass found with a funerary headdress in burial context (Veeckman and Bellens, 2013)

Totenhochzeit: finds from Germany

Examples of funerary headdresses, or '*Totenkronen*' or '*Brautkronen*' as they are named in German, were also found in various sites from Germany. According to Lippok (2011), this burial custom was for both Catholics as well as Protestants; this in contrast with what Portegies (1999) mentioned for Brabant (Netherlands). Regarding the decorations, Lippok (2011) reports that the basic frame for the funerary headdress is made of the so-called 'leonische Drähte'; Leonic wire. These copper wires were first made in the 17th century in Lyon; hence their name. Later, in the 18th and 19th century, other cities in Germany also produced these types of wires. The copper wire is coated with other material; this is often gold, silver or zinc. The ornaments for the funerary headdress were made by wrapping these Leonic wires around another Leonic wire, and sometimes the formed construction was again wrapped around another Leonic wire. Different shapes could be obtained; the frequent occurring shapes are ovals, flower or leaf-shaped objects, where the entwined base could be attached to the main frame. Figure 2.16 is an example of a diadem formed by these wrapped Leonic wires; it appears that variation exist in these ornaments. Some are loosely wrapped around a Leonic wire; some are tightly wrapped. Lippok (2011) reports that these leaf-shaped ornaments are 'filled' with fabric, more wires, or threads of fabric. Threads of fabric were wrapped especially between the wires. In addition, Lippok (2011) reports the usage of (hollow) beads as decorations with these ornaments.

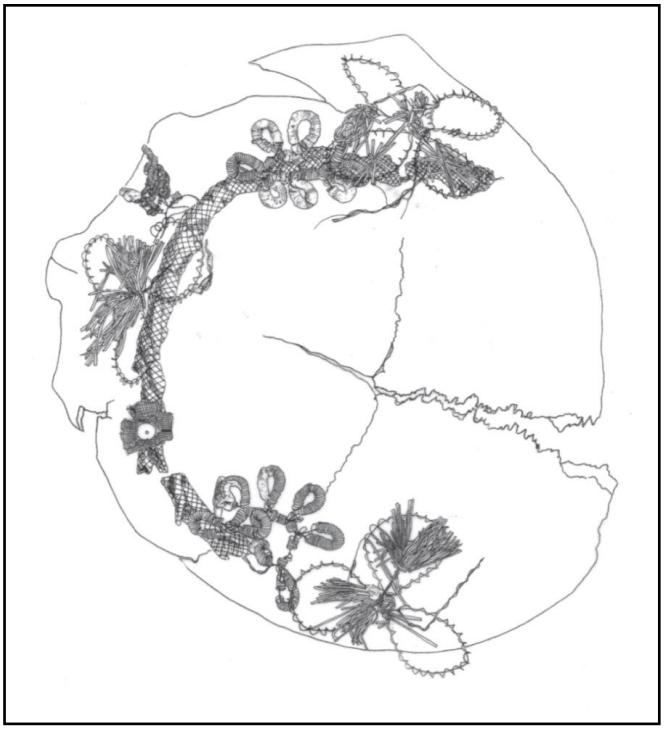

Figure 2.16: reconstruction of the decoration on the skull (Lippok, 2011, p.118). View is from above; in the left upper corner is the forehead.

Lippok (2011) defines three types of decorations occurring in this burial custom; a wreath, a diadem, and a bonnet/cap. The wreath can be differentiated from the other types as this one is completely enclosed. A diadem is often only present on the frontal and both temporals (mostly forehead area); whereas a bonnet/cap only covers a part of the head. According to Lippok (2011), to differentiate between a bonnet/cap and a '*Totenkrone*' may be difficult as the use of bonnets/cap in 'normal' burial custom are present in this period as well, as previously mentioned, and have quite similarities in decorations and shape. The usage of both a bonnet/cap and a '*Totenkrone*' is, however, also possible according to Lippok (2011, p.119).

Lippok (2013) also conducted a material analysis on the decorations and ornaments of the funerary headdresses. Both X-ray fluorescence analysis and the usage of a scanning electron microscope were used on funerary headdresses (n=48) excavated from sites in Berlin, Brandenburg, and Mecklenburg-Vorpommern. The funerary headdresses were first analysed macroscopically; this was done in order to gain insight on the probable materials used in the decorations and ornaments. As previously mentioned, the funerary headdresses frequently consist of decorations and ornaments made from Leonic wire; therefore a copper wire coated with either silver or gold was expected. The material analysis using the X-ray fluorescence and the scanning electron microscope were used to gain a detailed overview - the chemical composition of the materials used in these funerary headdresses. This chemical composition allowed more data to be extracted from these funerary headdresses; aspects such as dating, production centres, and trade routes were possible to analyse based on the chemical composition (Lippok, 2013, p.181). The macroscopic analysis resulted that most of the funerary headdresses consisted of braided wires of copper. These were the aforementioned Leonic wires, coated with gold and silver, and were shaped into ornaments by wrapping and braiding into leaf-shaped objects and flowers. The ornaments were, like previously described, decorated with paper and silk. Moreover, both round as well as squared wires were used for the decorations.

The wires as well as the (hollow) beads and pearls were then further analysed with aforementioned methods. The results indicated that the wires mostly consist of, as expected, copper (Cu). The coating would be silver, as high levels of Ag were noted (fig. 2.17). Moreover, in some wires a concentration of nickel (Ni) and zinc (Zn), in combination with copper, were also noted. The combination of copper and zinc indicates brass. The presence of nickel may also be from the coating according to Lippok (2013, p.186). It should be kept in mind that the alloy of copper, zinc, and nickel, which is called 'nickel silver' or 'German silver', can also be present. In conclusion, the Leonic wires which were chemically analysed are indeed copper wires coated with silver. Moreover, one of the decorations on a funerary headdress was a metal-fabric like object. In this, metal threads were braided with silk threads (fig. 2.18a). The construction, shape,

and type of this metal-fabric is quite similar to the previously described object from Aalst (see previous paragraph). Another remarkable decoration on this object was the fringes of metal braided with silk threads; the used alloy was brass (fig. 2.18b).

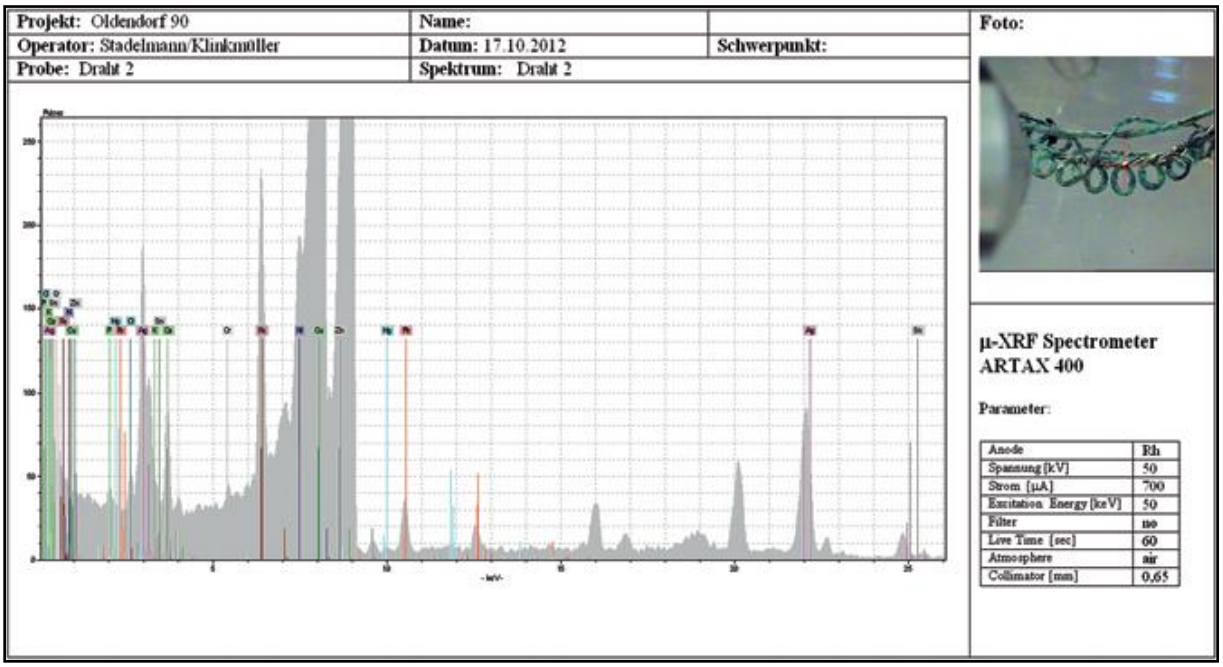

Figure 2.17: XRF results of decoration made with Leonic wire (Lippok, 2013, p.181).



Figure 2.18a, b: left (a): decoration of metal fringes and organic material. Right (b): close up (Lippok, 2013, p.191).

Other decorations documented on the funerary headdresses were either pearls or beads. For example, a real pearl was present with a garnet ornament on the crown (fig. 2.19a). In addition, some of the funerary headdresses had imitation pearls as decoration; Lippok (2013) indicates that these may have been for the less wealthy families. The beads found on the crowns are made of glass, and are often coloured (fig. 2.19b). Moreover, other decorations reported by Lippok (2013) are sequins, or larger metal 'leaves' (fig. 2.20).

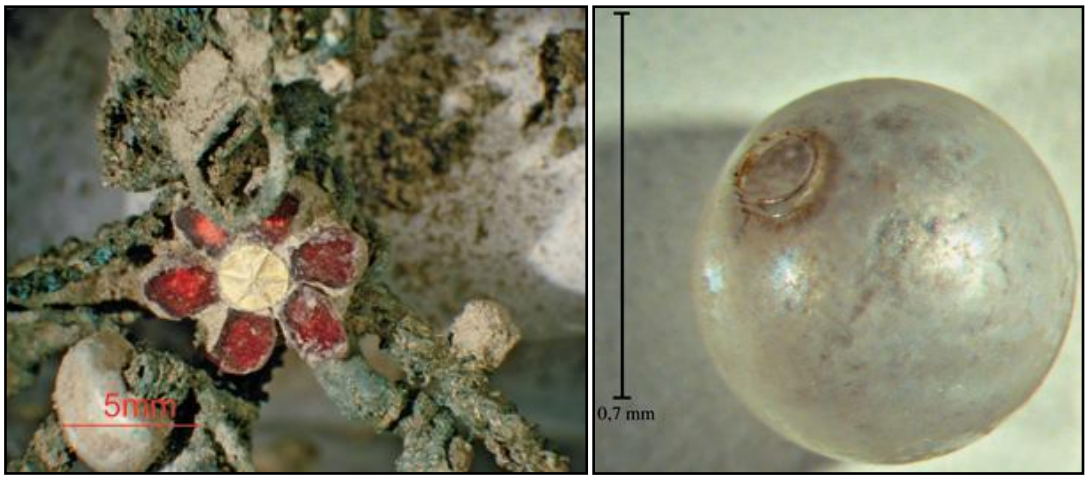

Figure 2.19a, b: left (a): pearl, Leonic wire, and garnet ornament (Lippok, 2013, p.197). Right (b): hollow glass bead used as decoration (Lippok, 2013, p.199).



Figure 2.20: decorative sequin-like object (Lippok, 2013, p.194).

Another, historical example is described by Müller (2006). A funerary headdresses is described, which is illustrated in a portrait from the St. Nikolai in Luckau. In this portrait, a deceased young girl is illustrated. She wears, according to Müller (2006) a funerary headdresses made of roses and rosemary leaves. A similar wreath, or more a bouquet, is also present in her lap and in her hands. No metal/copper frame is reported, but it is possible that this was present to support the

flowers and rosemary leaves. Moreover, other archaeological examples from Germany indicate that the location of the funerary headdresses does not always have to be near the head; these *'Brautkrone'* were also placed in the hands in the deceased (fig. 2.21). The 'real' funerary headdress, however, still remains a more frequently documented object; for example, one '*Totenkrone*' from the 19th century is present in the online database of the 'Staatliche Kunstsammlungen Dresden' and is still intact. According to the database, it is a small funerary headdress (5cmx8cm) and no further details are presented. This funerary headdress does illustrate the variation of decorations that can and may be present (fig. 2.22).



Figure 2.21: an example of a *'Brautkrone'* placed in the hands instead of on the head (Neuer Schottenfriedhof) (Stadtarchäologie Wien, 2013).



Figure 2.22: a '*Totenkrone*' from the online database of 'Staatliche Kunstsammlungen Dresden'. Inventory number B2290 (http://skd-online-collection.skd.museum/).

More archaeological examples come from sites such as Aknum (Kirchenburg) and near Leipzig (Heuersdorf); the decorations of these funerary headdresses are similar as the decorations mentioned by Lippok (2011; 2013). In figure 2.23a and 2.23b the Leonic wires and Leonic flowers are visible on the skull (with of course the correlating green discoloration of copper) and especially in figure 2.23b the decoration with beads is visible.



Figure 2.23a, b: left (a): skull with remnants of a '*Totenkrone*', excavated in Ankum (Lau, 2011, photograph by Hegenbarth-Jüdes). Right (b): a '*Totenkrone*' found in the grave of a young female (Richter and Scheidemantel, 2013).

Church fieldwork: finds from the United Kingdom

Examples from the United Kingdom regarding funerary headdresses or similar finds which are related to this type of burial custom were researched by Morris (2003; 2011). In one of her research articles (Morris, 2003) she describes her fieldwork conducted at five churches, where these 'maiden garlands', as named by Morris (2003), are still present. These churches were located in Shropshire, Derbyshire and Staffordshire and the fieldwork was conducted between 1990 and 2002, which includes documentation of the garlands. Besides the historical background on the garlands, which will be discussed in the next paragraph, she also addresses the form and construction of these decorations. It appears that the garlands as they are known from sites in the United Kingdom differ in their form and construction when compared to the earlier mentioned finds from the Netherlands, Belgium, and Germany. Morris describes how the maiden garland is often constructed on a wooden frame. It is formed in a beehive/bell-like wooden construction (fig. 2.24). Often hazel or willow was used, and the complete object is quite heavy. The construction on the garland is done by men as well as women; the men would make the wooden frame and women would decorate the frame. These decorations would consist of flowers, often made of paper (Morris, 2003, p.358). The phenomenon of these paper decorations also appears in different forms; paper gloves decorating the garland are common and the complete garland can also be made of paper (Morris, 2003, p.359). However, garlands made of gold or silver wire are also known in historical sources, and these were decorated with silver cloth, horn and ribbons. According to Morris (2003, p.360) the most common shape and form bell-shaped construction with paper gloves, and ribbons with some details about the deceased.

Instead of placing a crown-like object on the deceased's head, which is apparently more common in the Netherlands, Belgium, and Germany, this bell-shaped construction with decoration was placed on top of the coffin during the ceremony. The individual was, however, not buried with this type of decoration. After the individual was buried, the maiden garland would hang in the church for a period of time (fig. 2.24).

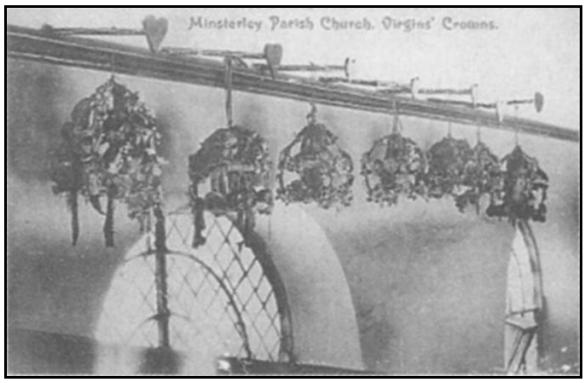

Figure 2.24: 'maiden garlands' hanging at Holy Trinity Church, Minsterley, Shropshire (Morris, 2003, p.362).

Usually, the garlands were removed after 12 months of mourning from their place in church. In some cases, the garlands remained after this mourning period; Morris mapped and researched the garlands which are still present in churches (fig. 2.25). In addition, this burial custom is still maintained in Hampshire.

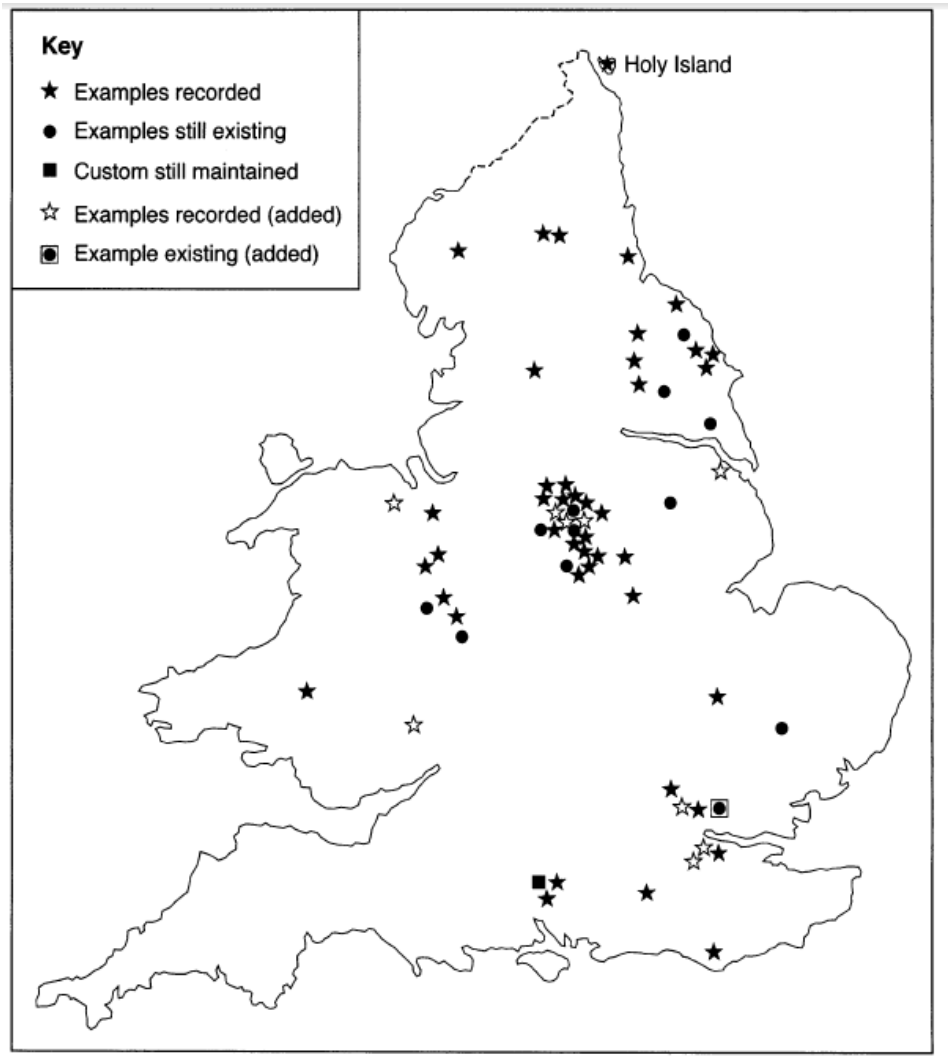

Figure 2.25: map showing the distribution of 'maiden garlands' in England and Wales (Morris, 2003, p.361).

Other archaeological examples from Europe

Funerary headdresses have also been documented at archaeological excavations in other regions of Europe. They are reported as a frequently occurring find or common burial custom in the post-medieval or the early modern period. As they are mentioned as a common burial custom, the finds and therefore the construction as well the decoration of these funerary headdresses are often not well described; their presence in graves is noted and their meaning is shortly discussed. Blažková *et al.* (2015) report the presence of funerary headdresses in Catholic churchyards, from sites in Central, Western, and Southern Bohemia; the detailed finds and construction of these funerary headdresses were, however, not described. Funerary headdresses were also found in graves from Linköping, Sweden. Tagesson (2015) does describe these funerary headdresses, or funeral coronets, and reports them as decorations that consist of wreaths and flowers, intertwined with copper threads. In addition, glass beads are also used to decorate these funeral coronets, and as figure 2.26 illustrates, the decoration can also consist of copper threads intertwined with leaves.



Figure 2.26: decorations of funeral coronets from Linköping, Sweden (Tagesson, 2015, p.29).

2.2.2 Historical data & literature on the funerary headdresses

However, additional information about this ritual was also gained by analysing written historical sources. Due to the fact that this ritual appears in a relatively recent period – generally, 1600 until now – information about how, why and who was buried in this way is not present in the archaeological data. Moreover, previous conducted studies on this burial custom also provided additional data regarding these aspects.

Time period

Though generally this burial custom is known from the 17th century and is, based on more recent sources (Venbrux, 1991; Morris, 2003), in some areas still conducted, the exact period in which this burial custom was first conducted is not known. The earliest example of a funerary headdress in the United Kingdom dates from 1680 (Morris, 2003, p.357). The archaeological example of a funerary headdress found in Haarlem, if this was indeed one, appears to be from a much earlier date: the 15th century. All other archaeological examples, and also the historical data, indicate usage of this burial custom at least in the 18th century. Data from Belgium, however, indicate the usage of this burial custom started in the late medieval period, with a continuous usage throughout the post-medieval period/modern period. At some point in the 17th century, though, the usage of this burial custom probably decreased. As previously mentioned, Portegies (1999, p.99) notes that usage of funerary headdress is only permitted if the family of the deceased paid the church extra money or 'rented' them. Kok (1990) mentions that in the 17th century, this burial custom was seen as 'superstitious'; which is also mentioned by Hirsch (1921, p.44). Furthermore, Hirsch (1921) and Kok (1990, p.174) note that in 1656, there was an attempt to forbid this burial custom and to display deceased children with these crowns (i.e. portraits; though this still occurred (see fig. 2.27)). This may very well be correlated with the overtake of the Protestant Reformation; though Lippok (2011) reports no difference in the burial custom during this period for Germany. Groen-Houcin (2013, p.13) also presents data that correspond with a decrease of this burial custom in this time period. Kok (1990, p.158) adds that because of this, shrouds for deceased children were decorated with crosses and stars, both in gold and silver; a much more simple and minimal decoration representing a funerary headdress. This aspect of funerary headdresses, as well as the decrease in the presence of them, are both archaeologically and historically not well represented. It should be kept in mind, however, that a decrease in this burial custom or prohibited usage of this burial custom may have resulted in a variation of the burial custom; such as the decorated shrouds. This has, of course, consequences for the archaeological visibility of the funerary headdresses from the 17th century.

The terminology

It should be noted that various terminologies appear in the literature, though their definition is not very different. Throughout this background chapter, a variation of terminology was already used; 'maiden crowns', 'death crowns', 'funeral coronets', 'funeral wreaths', etc. The variation in terminology of this burial custom, as well as the other processes regarding this burial custom (the process of decorating the deceased) made analysis, both for archaeological examples as well as historical data, quite difficult. The variation in terminology of this burial custom is shortly discussed, as this is correlated with geographical region(s) and may indicate slight differences in burial custom. For example, the decoration of the deceased was, at least in the eastern and southern regions of the Netherlands, called 'pelen' (Kok, 1990, p.172; Portegies, 1999, p.97). Roughly translated, 'purification' or 'cleaning'. For other regions of the Netherlands, there are no data on what this specific aspect of this burial custom, the decoration of the deceased, is called or named. Moreover, the aforementioned archaeological examples never refer to a specific term for this certain aspect of this burial custom.

However, the decorations do carry different names. Hirsch (1921) uses the terminology of 'garlands', and never refers to the decorations as 'crowns'. It seems that this is correlated with how the decoration was made. Both Hirsch (1921) and Kok (1990) describe the ritual in general quite similar (see below), and both refer to a poem by Van Den Vondel called "*Uitvaert van mijn dochterken*". This poem was written around 1626, and was about the funeral of Van Den Vondel's young daughter. In this poem, and also mentioned and interpreted by Hirsch and Kok, Van Den Vondel illustrates how his young daughter is buried but also, more importantly, how these 'decorations' were made. The decorations are referred to as 'garlands'. These 'garlands' were made by a friend of the daughter, or as told in the poem by a 'speelnoot' (playmate). This playmate apparently 'braided' a garland of rosemary, which was given to the deceased. Portegies (1999), Kok (1990), and Hirsch (1921) mention that the making of the decorations was often done by classmates, playmates and friends. Hirsch (1921) adds that in a Dutch song ("'t Hoedjes maecken", from „de Amsterdamsche Vreugdestroom", 1654) it is mentioned that these decorations are also made by certain 'beleefde mayden', indicating girls or young women. In addition, Hirsch points out that usually women made these decorations, who were called 'hoedjesmaecksters' and were paid to make these decorations. As both the song "'t Hoedjes maecken" and the term 'hoedjesmaecksters' use the word 'hoedjes', which means 'hat' or 'hats', it seems that besides 'garlands' the term 'hats' was also used. Groen-Houchin (2013, p.13) also reports the frequent usage of the term 'hat' in historical data, which can be translated to 'garland'. The usage of the term 'hat' is no surprise, as it seems from both archaeological data and historical data (fig. 2.27) that the individuals were often decorated with certain caps made from textile. In addition, Lippok (2011) also mentions the usage of 'caps' (*Haube*) in combination with other types of funerary headdresses can occur.

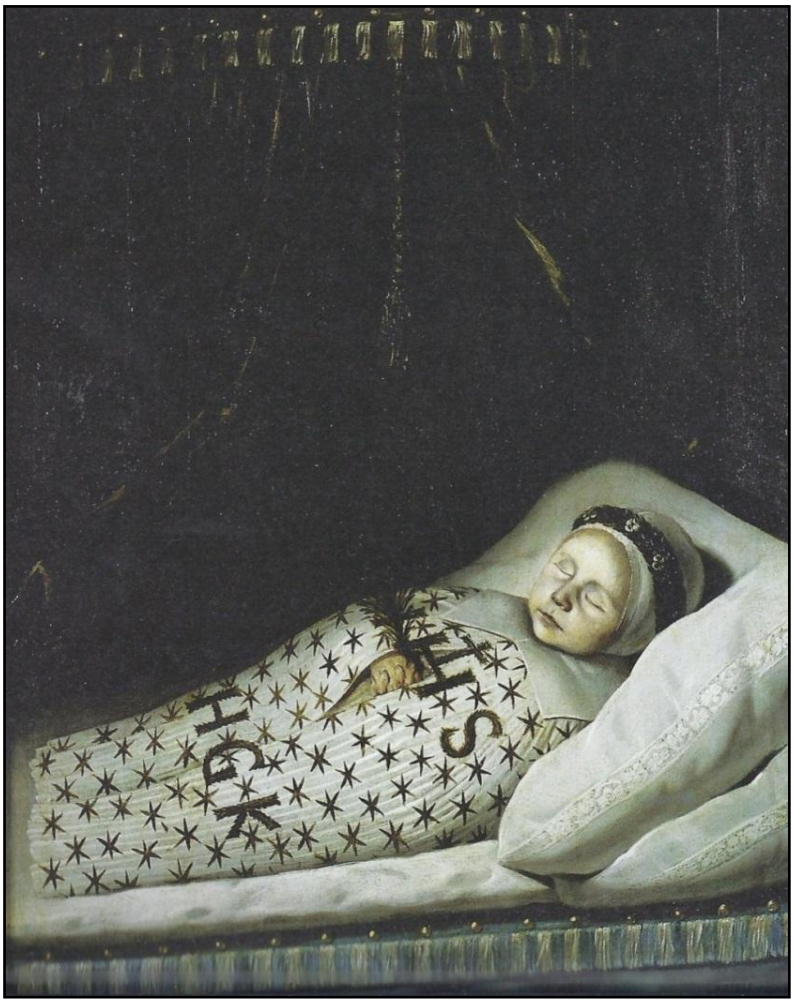

Figure 2.27: portrait of deceased child wearing a cap and a funerary headdress. Portrait is by J.J de Stomme, made in 1654 (Hirsch, 1921, p.43).

Other literature (Veeckman, 1997; Steel, 2007) still refer to this decoration as either 'crowns' or 'deathcrowns', and avoid the use of the term 'hat' or 'garland'. Moreover, the terms 'funeral wreaths' or 'funeral coronets' have also been used (Morris, 2011; Tagesson, 2015). The term commonly used in the United Kingdom is then again 'garlands', though the examples from the Netherlands indicate the term 'crown' is used in this region.

As previously noted in the introduction chapter, a more general term was established for this study to cover all possible variations of these decorations. The term 'funerary headdress' is used in this study to cover all decorations related to the head and therefore also possibly to this specific burial custom.

The decoration

Though the archaeological examples gave some insight, it is still a limited view of the complete decoration of a funerary headdress. Analysing historical sources on this burial custom allowed adding more data on decoration and construction of a funerary headdress. Hirsch (1921) provides the following data on this burial custom (translated from Dutch): "Unmarried individuals, young or old, were decorated in the coffin with garlands, which were composed of braided flowers, green and gold leaves". This is again from the poem by Van Den Vondel, and Kok (1990) describes the ritual, as previously mentioned, quite similar. Though Van Den Vondel describes a garland made of rosemary, other authors point to variations – though generally, these decorations are often plants, flowers or even (green) herbs (Kok, 1990; Portegies, 1999). Rosemary did, apparently, occur quite frequently in the construction and decoration of a funerary headdress (Groen-Houchin, 2013). In her analysis of rosemary which was found in a possible funerary headdress from Haarlem (as previously mentioned), Groen-Houchin (2013, pp. 12-13) discussed the symbolic presence of rosemary in burial context. In late medieval/post-medieval poetry rosemary is often displayed as a symbol of eternity, as it is evergreen, and is named a 'funeral flower'. Furthermore, Groen-Houchin (2013, p.13) discusses shortly three sources that report the usage of rosemary in burial context; specifically in funerary headdresses. These decorations are similar as described by Van Den Vondel; a garland braided of rosemary. In addition, it is also mentioned that the deceased was decorated with flowers and herbs. Van Sasse van Ysselt (1897) describes the burial customs for deceased children and unmarried individuals for different areas of Brabant, the Netherlands. It was a custom to place the deceased child on cotton wool (either a pillow or 'bed' of cotton wool). In his or her hands either a sprig of flowers (real or artificial) or palm branch was placed. A funerary headdress was placed on his or her head, though for some areas this is described as an "arch of flowers around the head or shoulders". These 'arches' were made by young girls from the village/neighbourhood. In addition, Van Sasse van Ysselt (1897) mentions the shreds of gold-like paper and tinfoil that are present in the coffin and on the deceased; this is also mentioned by Portegies (1999), though he also mentions glass splinters or slivers of tinfoil. These shreds of reflective paper appear also to be used for the deceased of 'the wealthy'; but indicate that reflective material was frequently used in this burial custom. Last, the unmarried adults were not to be buried with a sprig of flowers, but with a rosary. Van Sasse van Ysselt (1897) also mentions that a funerary headdress or wreath/arch was always placed on the head of an unmarried person; the absence of a funerary headdress/arch or wreath would indicate the deceased did not live a chaste life. Another decoration, mentioned by Schrijnen (1930) for the region of Brabant, documented for burial customs of children, is a cross made of 'green and flowers'. This decoration was made by young girls, carried during the funeral service by children, and was placed on the coffin. After burial, it was placed on the grave, instead of on or with the deceased.

To illustrate the funerary headdresses and the corresponding decoration of the deceased, a few photographs of deceased children are displayed in figure 2.28a, b, and 2.29. Figure 2.28a is a photograph made in 1906, whereas figure 2.28b is a photograph made in 1897. Figure 2.29 is a photograph from a later date; this was made in 1911. All of the photographs illustrate the funerary headdress worn on the head, as well as the sprig of flowers placed in the hands of the deceased child. Moreover, the children are dressed completely in white clothes/shirt. It is, however, not possible to determine based on these photographs if reflective material, such as shreds of tinfoil or glass, were present in the coffin. In addition, Richter (2010) researched funerary photography, or '*Totenporträts*' from the 19th century. One of the photos she researched and described is of a deceased baby (fig. 2.30). The baby is dressed in white shirt, decorated with oak leaves, and a funerary headdress with white flowers is present. Richter (2010) mentions that the oak leaves symbolize freedom, power, and hope; though they also symbolize eternal life. Note that in the other photographs (fig. 2.28a, b, and 2.29) oak leaves are not present, but the decoration (white shirt, crown of flowers) is very similar.



Figure 2.28a, b: left (a): photograph of a deceased child (1906). Right (b): another photograph of a deceased child (1897) (Sliggers, 1998).



Figure 2.29: a photograph of a twin, deceased, decorated with a crown and flowers (Sliggers, 1998).



Figure 2.30: photograph of a deceased child with decorations, no date, located in Basel (Richter, 2010, p.204).

Based on historical data as well archaeological data, two very distinct variations of these funerary headdresses should be established. These are the differences, in appearances as well as how/where the funerary headdress is deposited after the burial ritual, between data from the United Kingdom and the rest of Europe. The 'maiden garland' as described by Morris (2003; 2011) is quite different from the funerary headdresses described based on data from the rest of Europe. As previously mentioned, the 'maiden garland' documented in the United Kingdom is made from a bell-shaped object, which is decorated. This type of decoration is never worn by the deceased, and is placed on the coffin during the funeral service; afterwards it is placed in church. The shape, however, does resemble a crown-like shape, though of a larger size. Though the decoration is generally made of wood, unlike the other decorations documented for Europe, Morris (2003) does note that metal was also used. It should be noted that the decoration of both the 'English' and the other funerary headdresses are similar. On both types of funerary headdresses the flowers, leaves, ribbons, and paper are present. The 'English maiden garland', however, also have paper gloves attached and occasionally a ribbon with the details (i.e. name, age) of the deceased. Though similar decorations and customs of placing the decorations on top of the coffin have been reported for the Netherlands (Schrijnen, 1930; Portegies, 1999, p.98), it seems that this aspect of the burial custom occurs more frequently in the United Kingdom than elsewhere. Based on these variations, it can be concluded that though the intention of this burial custom is the same, the manner in which the custom is conducted differs.

Why and who

Both in historical data, as well as some reports on archaeological examples for this burial custom, there is mention of why and for whom these specific decorations were made. Moreover, some sources describe who made these decorations; some of these were previously mentioned (Hirsch, 1921; Kok, 1990). The reason for these decorations, and especially the reflective material was, according to Portegies (1999) to both familiarize the young children, and friends of the deceased, with death. It was a custom that everyone, and especially children, saw the decorated young child in his or her coffin. Their deceased playmate and friend was beautifully decorated; in a way that he or she represented an angel that would "pray for them all". This beautification of a deceased child, in order to present the child in a state of 'happiness', is also mentioned by Van Sasse van Ysselt (1897). Other sources, however, indicate that the decoration and presence of the crowns is to present the 'state of virginity' or the 'purity' of the deceased (Van Sasse van Ysselt, 1897; Veeckman, 1997; Morris, 2003; Lippok, 2011). Another explanation for this burial custom is often the 'Brides Of Christ' (Tagesson, 2015), or a 'marriage in death' (Venbrux, 1991); indicating that the individual was unmarried and as marriage was an important aspect, the deceased should be married. Veeckman (1997) refers to the deceased who were buried with this custom as 'witte lijken' (white bodies). They are seen as pure and innocent, as they died unmarried and therefore died as a virgin. Steel (2007) also points to the

usage of these funerary headdresses for young individuals. Lippok (2011) states that the *Totenkrone* are a symbol for virginity; though it was a custom for everyone who died unmarried, the funerary headdress is often viewed as a luxury item. It may therefore also be a representation of the wealth of a family; Lippok (2013) reports the usage of real pearls as well as imitation pearls, the latter probably for the less wealthy. In all previously mentioned studies and historical data, the decoration is for "everyone, unmarried and regardless of age". However, children appear to be most frequently buried with this burial custom; though historical data also indicates that unmarried adults, either male or female, were also buried with a funerary headdress (e.g. Van Sasse van Ysselt, 1897). The decorations and the funerary headdress were, according to various sources, made by young girls from the village or neighbourhood. Van Sasse van Ysselt (1897) describes how the decorations were made by young girls, and that these girls themselves paid for any expenses to make said decorations (e.g. flowers). This was both done for children and unmarried adults according to Van Sasse van Ysselt (1897). Schrijnen (1930) reports a different kind of decoration, as previously mentioned, but these were also made by girls from the village or neighbourhood. This is supported by data from Hirsch (1921), Kok (1990), and Portegies (1999); the decorations and funerary headdresses were made by classmates, playmates and friends of the deceased child. And, as the poem from Van Den Vondel indicates, the decorations were also made by a close friend of the deceased child. There is, however, no mention of who makes these decorations for unmarried adults. Hirsch (1921) describes, as previously mentioned, how these decorations were made by young women ('beleefde mayden' and 'hoedjesmaecksters') in general. It would seem these young women were paid to make such decorations, in contrast with what was previously noted by Van Sasse van Ysselt (1897).

2.2.3 Summary and archaeological visibility of funerary headdresses

Though there appears to be some variation in the decoration, the overall appearance of the funerary headdresses based on archaeological examples and historical data from the Netherlands and Europe illustrate a burial ritual involving a crown-like decoration made of iron or copper (alloy), which is placed on the individual's head. The metal frame of the funerary headdress consists of braided and wrapped metal/copper alloy wire, which is decorated with a variety of organic material.

Based on all aforementioned archaeological examples and historical data from Europe, it can be concluded that the usage of the Leonic wires in a funerary headdress is quite common. These wires of copper alloy, coated with either silver or gold, were not only used as a frame; the wires were also used, by wrapping wires together, to create floral and leaf shaped ornaments which were placed on the frame. Especially these floral and leaf shaped ornaments are very common in the decorations of the funerary headdress. In addition, these ornaments were decorated with fabric (especially silk) or paper. This was done by either wrapping threads of fabric or paper with the Leonic wires, or the ornaments were covered by these materials. However, sometimes floral ornaments were also created using these materials; these were also added to the frame.

Additional decorations on the funerary headdress vary from this point. Most common is the usage of real flowers, often rosemary or roses, or artificial flowers; made from paper or fabric. Using green leaves or green herbs as decoration also occurs; though there appears to be no use of one specific plant type. Archaeological examples from Germany and at least one archaeological example from the Netherlands (Didam) indicate the usage of beads as decoration. In addition, both archaeological examples and historical data indicate that the usage of reflective material (e.g. glass) in this burial custom is common in the Netherlands and Belgium; though not widely used in the Netherlands. Whether lack of archaeological data on this aspect is due to local usage or excavation techniques, is impossible to conclude.

The location of the funerary headdress does not appear to vary in archaeological examples as well as historical data; all indicate that the crown is around the head of the deceased. It should be noted that similar decorations, but located in the hands, also occur. The shape of the funerary headdress does, however, vary. The differentiation made by Lippok (2011) appears to be a correct and useful one; 1) a wreath, or closed crown-like object worn around the head, 2) a diadem, which only covers the forehead and both sides of the head, and 3) a cap which covers a majority of the head, mostly on the back of the head. It should be kept in mind that all can be decorated as previously described, and in addition some of these objects may occur simultaneously in the grave. Lippok (2011) mentions that a cap, which may also be an object of

'normal' use (i.e. a hat), may also be in combination with a wreath, and therefore indicate that this burial custom was indeed conducted. This may, however, be difficult to assess solely based on archaeological data.

Based on the aforementioned variation in the decoration of the funerary headdresses, it can be concluded that this burial custom may have some regional differentiation. In general, with the exception of the 'maiden garlands' from the United Kingdom, there appears to be quite some similarity in this burial custom; the variation may indicate a personal adaption of the burial custom. The general trend in the decorations is, however, mostly floral or leaf-shaped, in combination with organic material.

As previously mentioned, the 'maiden garlands' from the United Kingdom are slightly different in appearance than other known examples of funerary headdresses from Europe. The decorations on both objects have, however, quite some similarity. The intention and general decoration of both the 'English' and the other funerary headdresses are similar, but archaeological and historical data indicate at least differences between how this burial custom was conducted, and the overall appearance of a funerary headdress.

Historical data correspond with the archaeological data, even though not all mentioned types of decoration can be found in the archaeological dataset; this is of course due to preservation and conservation. The mentioned decoration by Venbrux (1991) such as candles burning on each corner of the coffin and the specific clothing is often not visible in the archaeological record. Though described in historical sources and found in the archaeological record, there are still remaining questions regarding the funerary headdresses; especially on the identification of this burial custom in the archaeological record.

Aforementioned data, both the archaeological as well as the historical data, are presented in table 2.2 for a general overview. Date and/or period have been added, if these data were available. Also, summarizing these data from table 2.2, a few inorganic and organic materials can be definitely expected in the burial custom of the funerary headdresses; this is presented in table 2.3. This general overview of the funerary headdresses and their appearance are a solid base to conduct this study; using the methods and materials described in the next chapter the archaeological visibility and identification of funerary headdresses can be researched.

Table 2.2: overview of the archaeological examples of funerary headdresses, including period/date and finds.

City/country/site	Period/Date	Decoration/material
Haarlem, NL	1430-1480	green discoloration on skull, mandible, atlas, upper limbs
		copper discoloration and presence of rosemary leaves
Oosterhout, NL	>1700	leaves and copper wire
Didam, NL	1700-1900	green discoloration on skull
		copper wire, Leonic flowers, Leonic wire
		glass beads, sequins
		textile, paper
s-Hertogenbosch, NL	1800-1900	flowers (real or made of paper/fabric)
		glass splinters, tinfoil, gold-like paper
		green herbs (based on historical data)
Sittard, NL	1800-2000	metal crown object
		long coat/suit
Busco Gerin, Switzerland	1960-now?	wreaths made of twigs and paper flowers
		wedding dress
Belgium	late medieval	metal crown object
	/post-medieval	flowers (real or made of paper/fabric/silk)
		fabric, paper (ribbon)
		beads, glass, glass splinters
Germany	1600-1900	copper wire, Leonic wires, Leonic flowers
		fabric, paper (ribbon)
		flowers (real or made of paper/fabric/silk)
		glass beads, sequins, pearls
United Kingdom	1600-1900	bell shaped construction/wood frame/metal frame
		flowers (real or made of paper/fabric/silk), paper gloves, ribbons
Sweden	post-medieval	Leonic wire, Leonic flowers
		Beads

Table 2.3: overview of expected material and decorations (inorganic and organic) for the funerary headdresses.

Inorganic	Organic
Leonic wires/Leonic flowers	Flowers (rosemary; roses)
Copper wires	Paper (ribbon/flower-object)
Iron wires	Silk (ribbon/flower-object)
Beads (glass)	Textile/fabric (ribbon/flower-object)
Smaller metal wires (fringes)	(green) Herbs
Leaf-flower objects of metal	Leaves
Glass (shreds/splinters)	
Pearls or imitation pearls	
Sequins	

3. Materials and methods

In this chapter the research methods used in this thesis will be described. As this research consists of multiple aspects, different methods and techniques were necessary and were applied. First, the methods used to select the sample under study will be presented. The methods used for the physical anthropological research will then follow; followed by the methods for documenting the burial ritual, and then the methods used for the chemical analysis will be described. Also, a short description on the database is also provided.

3.1 Selection process & start research

As presented in the introduction, during the excavation in Oldenzaal it became clear that numerous individuals had green discoloration present on the skull and/or on postcranial bones. It was not possible to analyse all of the individuals with green discoloration, and in addition some are probably not relevant for this study (i.e. only a small concentration of green residue in combination with no indication of any metal decoration or metal elements). Therefore, a selection had to be made, and the framework for the final selection was mainly based on the presence and location of green discoloration. Before the start of this research, the excavators had made a pre-selection list of individuals who had in the field been interpreted as individuals with 'crowns'. These are the individuals (n=15) of which it is certain a funerary headdress is present, based on artefacts (elements of the decoration present) and the green discoloration on the skull. However, more individuals (n=33) were added to this pre-selection. Though no specific decorations were present, these individuals were selected based on the presence/amount of green discoloration (and the location; mainly the skull), the preservation/conservation of the individual, and the preliminary sex and age assessments made during the excavation. As for preservation, only individuals with a good to average preservation were selected to ensure maximal data on the biological profile and to ensure the location of the green discoloration could be established (e.g. possible indeterminable skeletal elements). The field sex and age assessments were used so an equal distribution of males, females and young individuals was present in the selection; as this study used the hypothesis that a funerary headdress can be present for any individual, regardless of age and/or sex. Though the sex and age assessments were not always correct, it gave at least an indication of the sex and age distribution in this selection.

The final selection contains 48 individuals; in total 15 adult males, 17 adult females, 6 juveniles and 10 children (16 young individuals in total) were selected. After the full physical anthropological analysis these numbers shifted; but these will be presented in chapter 4. The distribution of these individuals in the cemetery is presented in figure 3.1. In table 3.1 an overview of the final selected find numbers and their field age and sex assessment is presented. The age categories mentioned in this table, and used throughout this research are 'adult' ('A'), 'young adult' ('YA'), 'juvenile' ('J'), and child ('Ch'). Sex assessments are either M / M? (male or male?) or F / F/ J? (female or female/juvenile?). For the younger individuals, the sex assessment is 'U' (from 'unknown', indeterminable).

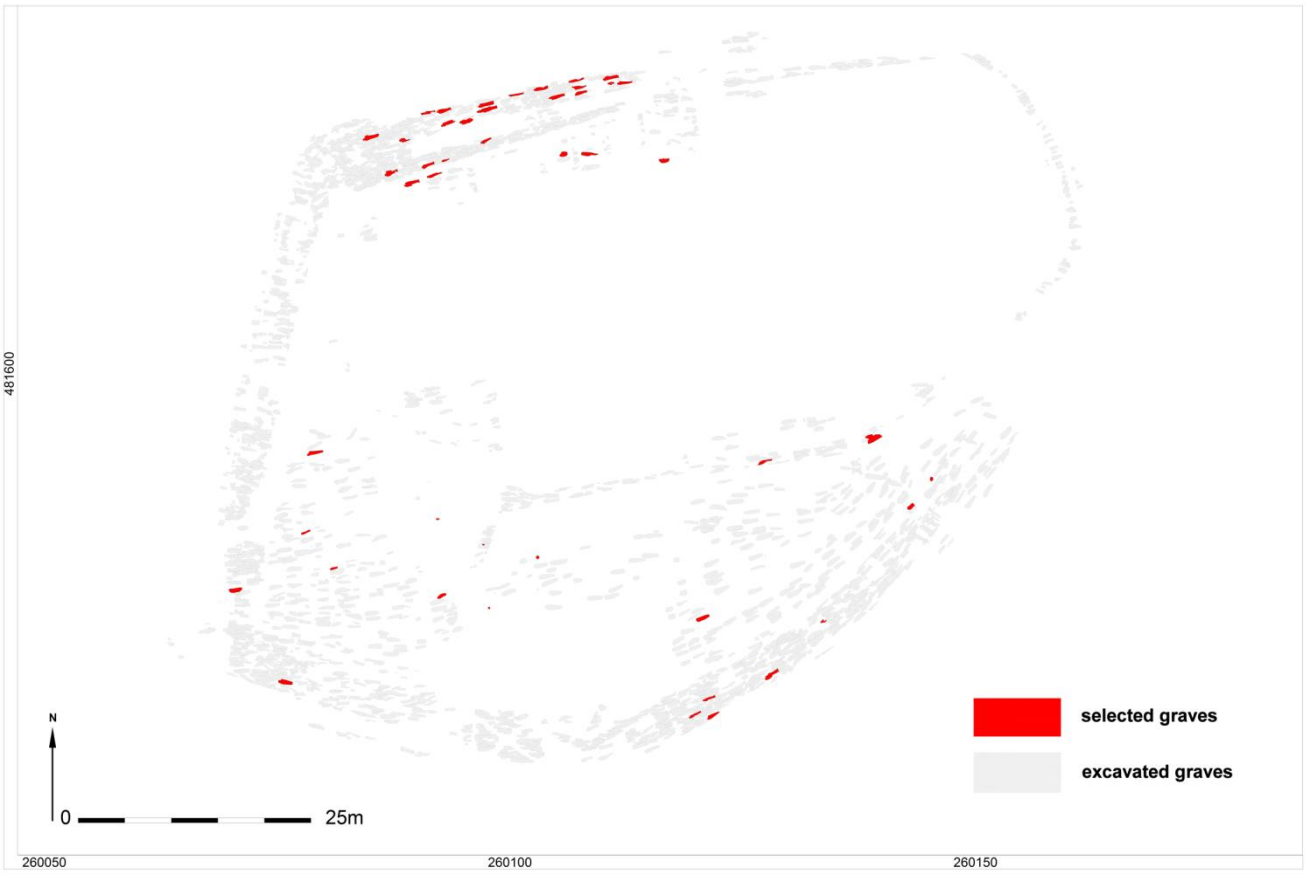

Figure 3.1: overview of the excavated graves at the Plechelmusplein. The graves in red are the selected graves for this research.

Table 3.1: overview of selected find numbers used for this research. Age and sex category are preliminary; these are field determinations.

Findnumber	Age category	Sex		Findnumber	Age category	Sex
899	A	M		3087	A	M?
912	A	F		3290	Ch	U
1024	A	M		3426	A	M
1100	A	M?		3515	J	U
1205	J	U		3797	A	F
1260	A	F		3974	A	M
1333	A	F		4139	A	M
1377	A	F		4453	A	F/J?
1694	A	F		4883	A	M
1695	A	F		4889	A	M
1707	Ch	U		4891	A	F
1773	A	F		5830	J	U
1796	A	M		5917	J	U
1831	A	M		5931	A	M
1835	A	F		6205	A	M
1875	A	M?		6211	Ch	U
1887	A	F		6260	Ch	U
1927	J	U		6373	Ch	U
2009	J	U		6451	Ch	U
2243	Ch	U		6476	Ch	U
2278	Ch	U		6478	A	F/J?
2366	A	F		6589	A	F?
2403	A	M		6749	A	F
2611	Ch	U		6786	A	F

3.2 Physical anthropological methods

To analyse and document the human remains for this research, the guidelines from the Manual for the Physical Anthropological Report were used (Maat, Van Der Merwe and Hoff, 2012). This manual consists of guidelines and methods for the dental analysis, sex assessment, age assessment, estimating the ante-mortem stature, recording the pathology, and more. Based on forms, tables and figures each part of the complete analysis could be done. The complete physical anthropological report used in this research consists of forms from this manual and additional forms from Raphaël Panhuysen, which will be described here below. Unless explained otherwise, for example if certain traits were missing and could not be scored, the methods explained below were all used.

3.2.1 Administration & skeleton status

The first form describes the administrative part of the individual: artefact number, level, date of recovery, site and photograph numbers. When this form is filled out during the excavation, the anatomical posture can be drawn. This was not the case for this study, since the human remains were analysed after excavation. Furthermore, this form contains a small summary of all the other forms that follow: sex assessment, age assessment, ante-mortem stature and any pathological remarks; all for a quick overview. In the 'overview' table on this form a small summary has been made of any pathological remarks or remarks in general (preservation for example), whether and which bones were taken apart for the chemical analysis, or for the complex method (see age assessment methods), and a summary of the artefacts and amount/location of the green discoloration (if present).

For the skeleton status, cranial and postcranial, the reporter can either indicate absence or presence of certain bones on the corresponding form. Any pathological remarks can also be indicated here. The cranial status form also requires the cranial index. This can be calculated by taking the maximum length and the maximum breadth, and then dividing the breadth by the length. The maximum length of the skull can be taken from the glabella onto the opisthocranion. The maximum breadth can be taken from euryon to euryon – the most lateral sides of each parietal bone. The cranial index calculation is divided into three ranges: dolichocranic (up to 74,9mm, long skull), mesocranic (75,0mm – 79,9mm, average skull) and brachycranic (80mm and more, short skull). There is an additional cranial form, to indicate the presence of the auditory ossicles and the synostosis of the synchrondroses. For the post-cranial status there is also an additional form to indicate any non-metrical variations (e.g. sacralisation L5, lumbarisation S1). Both have been added and used for the documentation of the physical anthropological analysis.

3.2.2 Dental analysis

The dental paragraph provides an overview of a complete dental analysis for each individual. For this, there is a form for the permanent teeth and the deciduous teeth. On the form, the reporter indicates the status of each tooth. The complete maxilla and mandible (as far as these are present) are analysed for teeth which can be inspected in jaw (I), missing positions of the jaw (M), unerupted teeth (U), post-mortem lost teeth (P), ante-mortem lost teeth (A) and congenitally absent teeth (C). The number of teeth assigned to these classifications should add up in the equation: the number of (normally) erupted teeth + any supernumerary is equal to number of inspected teeth, missing positions, ante-mortem loss and post-mortem loss together. The molars are also inspected and scored for any attrition, using classifications (Brothwell, 1981; Maat, 2001). This attrition can aid in the age determination (see below). Both maxillary and mandibular teeth are also analysed for any signs of enamel hypoplasia (enamel growth defects), carious lesions, abscesses, alveolar atrophy (Brothwell, 1981), periodontitis, mechanical traumas and/or any other remarks. Abbreviations which were used in the dental paragraph of this research are: c = *carious lesions* and 1+ / 1 / etc. = *molar attrition* / h = *hypoplasia.* For the deciduous teeth, the specific phase of eruption or mineralization of an element is documented. This is based on the stages of mineralization in the crown, root and apex. The specific stages and recording system is from (Moorrees, Fanning and Hunt, 1963). The documentation of enamel hypoplasia, of which the location is an indication of at what age there was probably stress (malnutrition), is based on Reid and Dean (2006). The notation of each tooth element is according the FDI system (Fédération Dentaire Internationale). The complete jaw (maxilla and mandible) is divided in four quadrants, from the upper right (1), to the upper left (2) and from the lower left (3) to the lower right (4). Each element in the quadrant is assigned to a second number, beginning from 1 at the medial side to 8 at the distal side. The quadrant number and element number are combined; for example 41 is the first incisor of the lower right quadrant.

3.2.3 Pathology analysis

Every individual was analysed for pathological indications, this was done through macroscopically examining every bone, and analysing if there were any abnormalities. Pathological indications are for example fractures, diseases (infectious and/or congenital), and congenital defects and nutrient deficiency/malnutriency. The aforementioned enamel hypoplasia is also mentioned in this analysis, with an indication as to at what age this might have happened.Several forms to documented these pathological remarks were available and used during the physical anthropological analysis. On these forms, the possible and probable presence of pathological indications could be indicated, as well as possible/probable diagnosis.

3.2.4 Methods for sex assessment

For the sex assessment of the individuals both non-metrical as well as metrical methods were used. All methods for sex assessment can only be used on adults, since young individuals tend towards a more feminine degree. However,in some cases it was possible (for juvenile individuals) to give at least an indication of a possible sex assessment using these methods.

The non-metrical method used in this research is based on the sex assessment methods from the Workshop of European Anthropologists (WEA). This consists of scoring certain traits of the pelvis (Acsádi and Nemeskéri, 1970; Workshop of European Anthropologists, 1980) and the skull (Broca, 1875; Acsádi and Nemeskéri, 1970; WEA, 1980). These traits will be scored between -2 (hyperfeminine) and +2 (hypermasculine), where 0 is indifferent. These scores will be multiplied with the weight of each trait. Each trait has a different weight, e.g. the score for the pre-auricular sulcus weighs 3, whereas the iliac crest weighs 1. The sum of these scores multiplied, and then divided by the amount of the traits which were scored, gives an indication of the sex. Overall, individuals with scores below the 0 are female (-1 and -2), and above the 0 are male (+1 and +2), with the 0 score being indifferent/indeterminable. For the pelvis, this method consisted of 10 traits (table 3.2) and for the skull there were 16 traits (table 3.3). The traits of the skull are also divided by cranium, mandible and the complete skull (caput).

It should be noted that the results of the morphological sex assessment are more reliable when they are compared with another comparable population. When compared with a different unrelated population, different traits could be less/more profound than other traits, i.e. the females would tend to be more masculine or vice versa.

Table 3.2: overview of the pelvic traits used for sex assessment.

Trait	Weight (W)	Score (X)	W x X
Pre-auricular sulcus	3		
Greater sciatic notch	3		
Pubic angle/arch	2		
Arc composé	2		
Innominate bone	2		
Obturator foramen	2		
Ischial body	2		
Iliac crest	1		
Iliac fossa	1		
Pelvic inlet	1		

Table 3.3: overview of the skull traits used for sex assessment.

Trait	Weight (W)	Score (X)	W x X
Glabella	3		
Superciliary arch	2		
Frontal/parietal tubera	2		
Frontal inclination	1		
Mastoid process	3		
Nuchal plane	3		
External occipital protuberance	2		
Temporo-zygomatic process	3		
Zygomatic bone	2		
Supramastoid crest	2		
Orbit	1		
Sum W:	24	Sum W x X:	
Mandible (general)	3		
Mentum	2		
Angle	2		
Inferior margin	1		
Sum W:	8	Sum W x X:	

The metrical method for sex assessment is based on measuring the Antero-Posterior Diameter (APD) and Maximum Antero-Posterior Diameter (APD-max). This is done on the femora and the tibiae. For the femur, this is the largest antero-posterior distance along the linea aspera (MacLaughlin and Bruce, 1985). For the tibia, this is at the level of the nutrient foramen. The APD-max for both the femur as well as the tibia is done at the same level of the APD, but then the maximum deflection is recorded (Maat, Van Der Merwe and Hoff, 2012, p.8). It should be mentioned that this method is usually used when for a related population, of which the sex is known, and the APD and the APD-max are known. Comparing results should then give an indication if the diameter is 'female' or is 'male'. For this research, the diameter ranges plotted in Maat, Mastwijk and Jonker (2002) were used – though it should be noted that, due to a huge overlap in ranges, the female diameters also fell in the range of the males. This means that determining the females from the males is more difficult, if not impossible.

3.2.5 Methods for age assessment

To make an age assessment, different methods were used. First of all, it was related to the indication of age of the individual; other, different methods are used for young individuals than for older individuals.

The methods for making an age assessment during growth (young individuals) consist of dental eruption and mineralization, long bone growth, and certain closures and fusions of skeletal elements. Based on dental eruption and mineralization it is possible to give an age indication; certain teeth erupt at a certain age (Ubelaker, 1978; WEA, 1980). The closures and fusions of the skeletal elements also give an age indication – different growth plates all fuse at different age ranges (Scheuer and Black, 2000; Schaefer, Scheuer and Black, 2009). Noting whether a growth plate is non-fused, fusing or fused, an age indication can be given. The last method, of the long bone growth, uses the length of the long bones and the reference tables of Maresh (1955). For this, a correction had to be made for the population under study; the average stature should be taken into account. The stature of adults in the USA reference population of Maresh is 178,2cm. For the population under study, this was 170,8cm for the males and 161,3 for the females. Dividing 178,2 with 170,8 results in a ratio of 1.04; dividing 178,2 with 161,3 results in a ratio of 1,104. Any bone length measured in the population under study has to be multiplied by this ratio to use the tables of Maresh (1955), depending on the sex estimation.

For the adults, which are individuals with permanent teeth, no fusions or long bone growth, other methods are used. These consist of the complex method, the analysis of the progress of ossification of the sternal end of the 4th rib, molar attrition, the pubic symphysis, and the auricular surface. The complex method (Acsádi and Nemeskéri, 1970; Sjøvold, 1975; WEA, 1980) is based on different age indicators: the symphyseal face of the pubis, spongiosa of the proximal humerus and femur, and the endocranial suture obliteration. For each age indicator there are figures to determine a certain phase, and when combined, these phases will give an age assessment, using the corresponding tables. The tables used for this age assessment (Sjøvold, 1975) are presented in the manual (Maat, Van Der Merwe and Hoff, 2012). In addition, other methods for an age estimation were used as well. Based on the progress of ossification at the sternal end of the 4th rib (İşcan, 1986) it is also possible to make an age assessment. The ossification at the sternal end of the 4th rib (which can also be done on the 3rd or 5th) undergoes different morphological phases – all of which are described and documented by İşcan (1986) and İşcan and Loth (1986a; 1986b). This method is also sex related. When molar attrition is present, it is possible to make an age assessment based on the amount of attrition (Brothwell, 1981). It is population related, and for the population under study the results in Maat, Mastwijk and Jonker (2002) were used. The pubic symphysis could also be used as an age indicator; the same indicator used in the complex method, though the phasing is different (Brooks and

Suchey, 1990). This method is also sex related, and provides a large age range. The method of the auricular surface is based on the morphological changes of sacro-iliac joint with age, or rather the auricular surface of the pelvis (on the medial side of the ilium) (Lovejoy *et al.*, 1985; Buckberry and Chamberlain, 2002).

3.2.6 Estimation of ante-mortem stature

On the form with the table to score the pelvic traits, it is also possible to state taken measurements, metric variations and stature. Measurements were, if possible, taken from the left and the right bones. They include measurements from the humerus (maximum and total length), radius (maximum and parallel length), ulna, femur, tibia (total length, maximum condylar malleolar length) and the fibula. To establish metric variation, measurements of the humerus (diameter head, bi-epicondylar width, condylar width), femur (maximum APD, diameter head, condylar width) and tibia (APD) were taken.

Where possible, an estimation of the ante-mortem stature was made for the adult individuals. For this, the length of the long bones and the equations of Trotter (1970), Trotter and Gleser (1952; 1958) and, if possible, Breitinger (1937) were used. Of Trotter and Gleser, the equations for white females and white males were used, whereas for Breitinger the equations could only be used for males. Each long bone has a different equation, all with different standard deviations as well. The equation for the femur, the one with the lowest standard deviation, is the most used in this study.

3.3 Methods for documenting the burial ritual

A variety of methods were used to analyse the burial custom. First, the documentation of either presence or absence of green discoloration was of importance in knowing whether or not bones were to be selected for the chemical analysis. The exact location of this green discoloration was also of importance, as well as any other residue (organic material, iron) on the bones or other finds (small artefacts; glass, pottery, metal fragments, etc.). For each individual the presence and the location of the green discoloration were examined macroscopically after the physical anthropological analysis as described above. With the use of the skeleton and cranial status form, the locations with green discoloration were documented. Each bone showing indications of residue (either green discoloration or any other residue) was held separately for XRF measurements (see 3.4), documented and photographed.

After the physical anthropological analysis, and the initial documentation of green discoloration and finds on the bone, the remaining soil residue (if present) was also analysed for artefacts. This includes large to middle artefacts (e.g. nails from the coffin, pottery) and small to very small artefacts (e.g. copper residue, metal fragments/decorations, glass, and organic material). Any artefact found in this soil residue was held separately for further analysis, and was documented and photographed. All artefacts not selected for chemical analysis (see 3.4), were analysed either macroscopically or microscopically, depending on their size. If macroscopical analysis did not provide sufficient data on either determination of material or object, finds were further analysed microscopically. When possible, photographs were taken of the object(s) under the microscope. The complete list of artefacts and finds, as well as the location(s) of green discolorations were noted under 'overview' on the first form of the corresponding individual.

Discolorations on bone were documented by colour. The results of these findings, as presented in the subsequent chapter, are divided per body region. This is done in order to provide an overview of certain finds in each body region, instead of presenting an overview of each individual and corresponding finds. These body regions are the skull, torso, shoulder girdle, upper limbs, lower limbs, hands, and the pelvic girdle. The skeletal elements in these specific regions are displayed in table 3.4; extracted and summarized from the database (see 3.5). Any finds and/or discolorations on the bones of the feet are included in the body region of the lower limbs. Only finds and/or discolorations on the bones of the hand are separately discussed, though documented with the upper limbs in the database. Discussing the discolorations and finds separately for the hands made it possible to research and discuss certain locations of green discoloration in correlation with the presence of grave goods placed in the hands, such as rosaries.

Table 3.4: overview of the body regions and the associated skeletal elements.

Body region	Skeletal elements		Body region	Skeletal elements
Skull	temporal-parietals		Thorax	sternum
	dental			manubrium
	frontal			ribs
	parietals		Pelvic girdle	auricular surfaces
	occipital			ilium
	temporals			ischium
	zygomatics			pubis
	maxillae			acetabulum
	mandible			sacrum
	orbits		Upper limbs	humerii
	sphenoids			ulnae
	frontal-parietals			radii
	sphenoid-temporals			carpals
	temporal-occipitals			metacarpals
	foramen magnum			phalanges
	sagittal suture		Lower limbs	femur
	temporalis suture			tibia
	coronal suture			patella
	lamboidal suture			fibula
	sphenoid-frontals			tarsals
	occipital-parietals			metatarsals
Shoulder girdle	clavicles			phalanges
	scapulae		Spine	cervical
				thoracic
				lumbar

3.4 Methods for the chemical analysis

The artefacts and bones with green discoloration were, as mentioned above, selected by macroscopic analysis and held separately for the chemical analysis.

XRF measurements
The handheld XRF (X-ray fluorescent) was used for the chemical analysis. The specific device used for this chemical analysis was a Thermo Scientific Niton XL3t p- XRF. The handheld XRF was specifically used because of availability, but also the practical use of this device on bones; size and shape of bone differed, as well as the location(s) of discoloration(s). All of the measurements which were taken on the bone were done in a bulk measurement ('mining mode' Cu/Zn, measuring multiple chemical elements at the same time). Measurements on metal were performed in the bulk measurement of the 'soil mode'.

Measurements were taken at the locations of the green discoloration, or, if present, on other types of discoloration. Each measurement would of course include a high concentration of calcium (bone) and perhaps other concentrations of chemical elements which would normally be present in the soil. Because of this, baseline measurements were also taken on the bones. These baseline measurements were taken, if possible, on the areas of bone were no green (or any other) residue was present. Measurements with the XRF were also taken of the metal decoration(s) and metal element(s). Fragments of copper, iron or any other small particles (fragments of copper residue) were also measured. Artefacts/finds like pottery, nails or glass were left out of the chemical analysis as their chemical composition would not be an addition to the analysis of the burial ritual. However, fragments of glass might still hold some potential for a chemical analysis, so a comparison can be made between these glass fragments found in different burials (e.g. same chemical composition?). This was not conducted in this research, but holds possibilities for future research. As already mentioned in the introduction chapter, the funerary headdresses documented during the excavation were already analysed with the handheld XRF by Bertil van Os. Measurements and the corresponding values will be combined with the chemical data which will be gained from this study. The documentation of the measurements was done in an Excel sheet. The measurement number (created by the XRF device) and find number were noted, as well as the type of bone analysed. Furthermore, the exact location was documented where both the residue measurement and baseline measurement were taken, as well as any remarks (i.e. no background measurement possible due to fragmentary bone).

The results of the measurements, the chemical data, were analysed in collaboration with Bertil van Os and Hans Huisman (both RCE).

3.5 The database

The results of the physical anthropological research and an overview of the documented finds for each individual were stored in a database. All data were of course already documented on the forms, a spreadsheet document and a text document; but to run specific queries on these data, a database was necessary. The database was built with Microsoft Access 2003, and the use of specific Visual Basic code was necessary to run specific queries and commands. The structure of the database will be explained in this paragraph.

3.5.1 Metadata: list of tables and their design

Both the metadata and the design of the tables in this database will be presented in the following sub-paragraph.

Inventory table and finds table

The main two tables are the inventory table (*invent_bone*) and the finds table (*findings*), which are linked. The inventory table displays the results of the physical anthropological analysis; data such as sex, age, ante-mortem stature, and pathological remarks are presented per individual. Linked to each individual is the finds table; in here each find which was documented with the individual is stored. The tables are linked by the find number of each individual.

The following overview presents the metadata of the inventory table:

Field	Datatype	Relationship/other	Lookup query	Function
ID	Autonumber	Autonumbered ID		Unique ID number for each individual
vnr	Number (Long Integer)	Primary Key / Indexed		Find number of the individual
krn_nr	Number (Long Integer)			Crown number (if present)
ds_nr	Text (255)			Box number for storage
agecat	Text (255)	Combo Box/Lookup query	SELECT ref_agecat.ref_agecat FROM ref_agecat;	Age category of the individual (e.g. adult)
sex	Text (255)	Combo Box/Lookup query	SELECT ref_sex.ref_sex FROM ref_sex;	Sex category of the individual
age min	Number (Double)			Minimal age boundary
age max	Number (Double)			maximal age boundary

AMstat	Number (Double)			ante-mortem stature
pathology	Memo			Pathological remarks and other remarks

The metadata for the finds table is as follows:

Field	Datatype	Relationship/other	Lookup query	Function
XRF	Text (255)			XRF number
Id	Autonumber	Primary Key / Indexed		Unique ID number
Vondst nummer	Number (Long Integer)			Find number of the individual
Type residue	Text (255)	Combo Box/Lookup query	SELECT ref_residue.* FROM ref_residue;	Type of residue
bone_cat	Text (255)	Combo Box/Lookup query	SELECT ref_bone_cat.bone_cat FROM ref_bone_cat;	Category bone
bone_ond	Text (255)	Combo Box/Lookup query	SELECT ref_bone_ond.bone_ond FROM ref_bone_ond;	Skeletal element
bone_loc	Text (255)	Combo Box/Lookup query	SELECT ref_bone_loc.bone_loc FROM ref_bone_loc;	Anatomical location/position

The relationship between the inventory table and the finds table is a 1-to-many link, with enforced referential integrity. Figure 3.2 presents an example of one individual with the linked data.

ID	vnr	krn_nr	ds_nr	agecat	sex	age min	age max
4	899		D44	V	M	43,75	5

XRF	Id	Type residue	bone_cat	bone_ond	bone_loc
1513	256	green	skull	orbit R	inferior
1513	21	green	skull	zygomatic R	superior
1514-1515	22	green	skull	sphenoid R	inferior
2446-2447	23	green	spine	L5	body anterior
3476-3477	24	green	upper limbs	ulna L	distal-medial

Figure 3.2: example from the database, presenting an individual with linked data. Physical anthropological data is in the upper record (find number 899, etc.) and XRF/data on finds is in the record below.

References tables

In both the inventory table as well as the finds table, combo boxes/look up queries are used. These look up queries are data that come from reference tables. In total there are 6 reference tables.

ref_bone_cat

This is the reference table for bone_cat in the finds table. In total there are 7 categories: skull, shoulder girdle, thorax, pelvic girdle, upper limbs, lower limbs, and spine. The design of this table is as follows:

Field	Datatype	Relationship/other	Lookup query	Function
ID	Autonumber	Primary Key / Indexed		Unique ID number
bone_cat	Text (50)			The reference list for the bone category

ref_bone_ond

This is the reference table for the skeletal element field in the finds table. This table is linked with the *ref_bone_cat*; this is based on the ID fields. For example, the bone category skull (ID # 1) is linked with several skeletal elements of the skull (e.g. temporal-parietal R, temporal-parietal L, frontal, frontal-parietal R). The design of the skeletal element table is as follows:

Field	Datatype	Relationship/other	Lookup query	Function
ID	Number (Long Integer)			The ID number of the bone_cat table
bone_ond	Text (255)			The reference list of the skeletal elements
ID_item	Autonumber	Primary Key / Indexed		Unique number of each skeletal element

ref_bone_loc

This is the reference table for the anatomical location/position in the finds table. This table is linked with *ref_bone_ond*, based on the ID fields. Again, an example of these linked data is the skeletal element 'frontal' (linked with 'skull' from the bone category table) and bone locations such as 'superior', 'inferior', and 'anterior'. All common anatomical planes, positions, and locations are included for each skeletal element.

The design of this table is as follows:

Field	Datatype	Relationship/other	Lookup query	Function
ID	Number			The ID number of the bone_ond table
bone_loc	Text (50)			The reference list for the bone locations

As mentioned, the three aforementioned reference tables are all linked. The link between *bone_cat* and *bone_ond* is a 1-to-many relationship; this is the same for the *bone_ond* and *bone_loc*. Figure 3.3 presents an example of all the linked data.

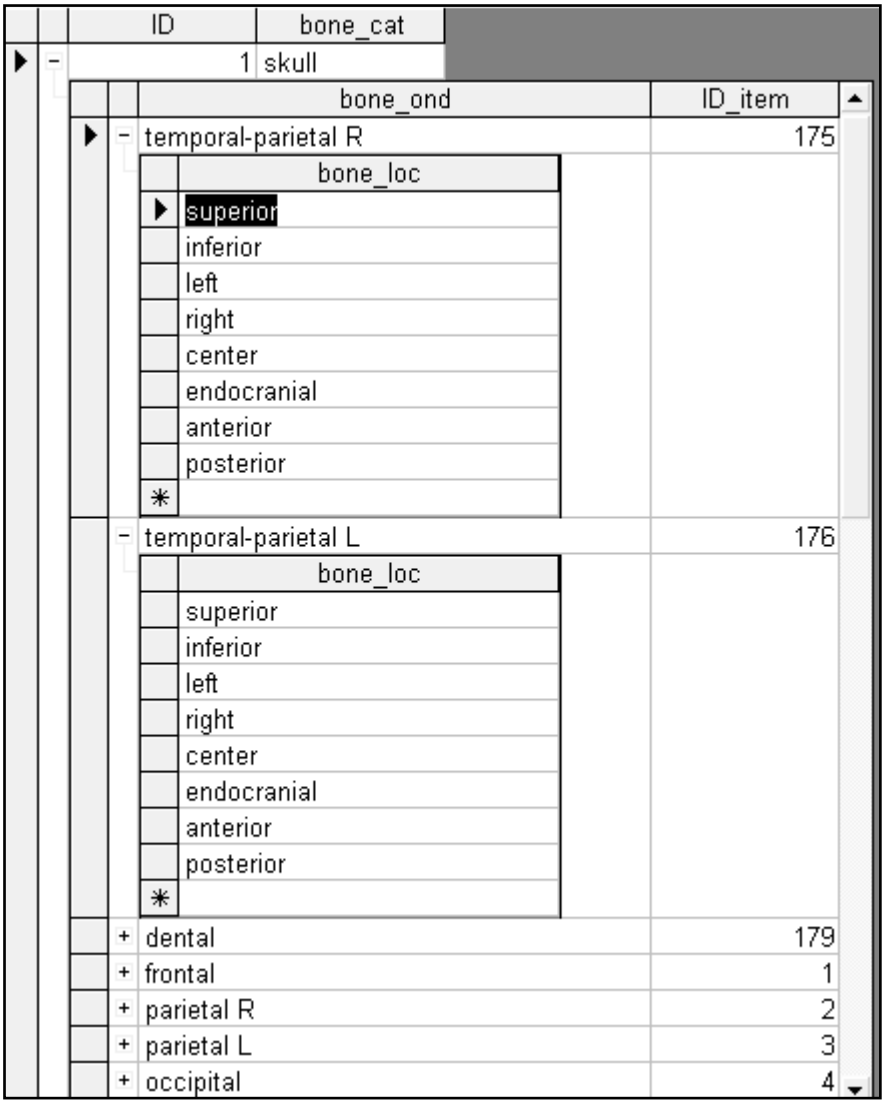

Figure 3.3: example from the database, presenting linked data of the skeletal regions and the corresponding skeletal elements, as well as the anatomical locations.

Besides these three main references tables, there are three other references tables. All three have the same design; they consist of only 1 field (data type: text (255)). For the reference table of the age categories, the data includes 'adult' (V), 'child' (K), and 'juvenile' (J). The reference table of the sex category includes 'male' (M), 'female' (VR', and 'indeterminable' (O). Last, the reference table for type of residue consists of more data. The list consists of 'green', 'blue', 'iron', 'mxx', 'gls', 'oxx', 'aw', and 'mcu'. These abbreviations are from the ABR (Archeologisch Basis Register), explained in table 3.5.

Table 3.5: used abbreviations in the database.

Abbreviation	Explanation
mxx	Metal indeterminable
gls	Glass
oxx	Organic indeterminable
aw	Pottery
mcu	Metal copper

3.5.2 Metadata: queries & methods

A search form (*opvraaglijst*) was made to conduct specific queries on the entered data. This allowed filtering the data based on skeletal element, location, or for example type of residue. For example, filtering the data allowed a full list of all individuals documented with green discoloration on the frontal bone. As a specific location of each discoloration was also documented; these data can then be again filtered on location; e.g. on the superior surface of the frontal. Combining and filtering data of the discolorations, finds, and the physical anthropological analysis provided insight on specific patterns of discolorations and finds; perhaps present for specific individuals.

The search form is nothing more than a SQL query (*Search*), which runs based on what is entered in the form itself. On the search form, the user can select with drop-down menu's specific data to conduct the query (fig. 3.4). For example, the user can select from the search form a skeletal category (e.g. skull) and run the query. All records containing this specific skeletal category will then appear; this in combination with the data on the individual. In addition, combinations can be made in the search form. When choosing a skeletal category (e.g. skull), a skeletal element can also be selected (e.g. frontal), and, a specific location. Moreover, this can also be in combination with type of residue. For example, the search query can list all the individuals with green discoloration on the left side of the frontal. The queried data are stored in a different form (*Search*).

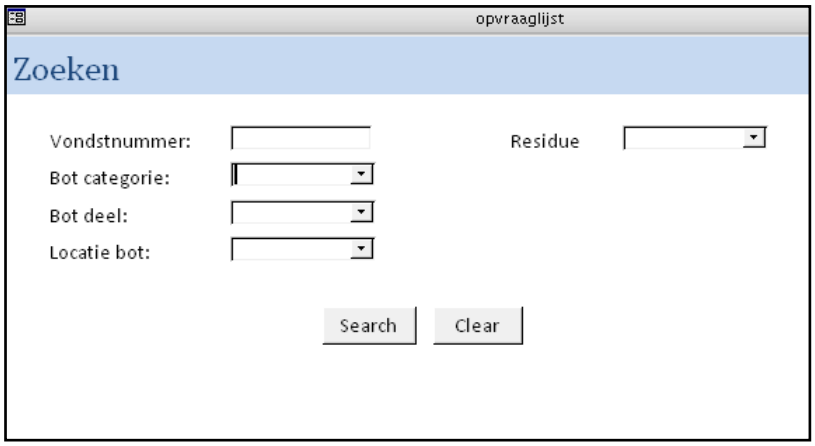

Figure 3.4: the interface of the search function in the database.

The SQL for the search query is as follows:

```
SELECT
Findings.bone_cat,
Findings.bone_ond,
Findings.bone_loc,
Findings.[Type residue],
invent_bone.vnr, *
FROM invent_bone
INNER JOIN Findings ON invent_bone.vnr = Findings.Vondstnummer
WHERE (((Findings.bone_cat) Like '*' & [Forms]![opvraaglijst]![bone_cat] & '*')
AND ((Findings.bone_ond) Like '*' & [Forms]![opvraaglijst]![bone_ond] & '*')
AND ((Findings.bone_loc) Like '*' & [Forms]![opvraaglijst]![bone_loc] & '*')
AND ((Findings.[Type residue]) Like '*' & [Forms]![opvraaglijst]![residue] & '*')
AND ((invent_bone.vnr) Like '*' & [Forms]![opvraaglijst]![vnr] & '*'));
```

In addition, the filter function built in Microsoft Access was also used to filter specific data and analyse patterns and correlations between green discoloration, finds, and their locations on skeletal elements of skeletal regions. The results of this analysis are presented in the subsequent chapter.

4. Results

In this chapter the results will be presented. The results of the physical anthropological analysis are divided by sex category, and for each category the number of individuals as well as any remarks will be described. Results from the find analysis will also be presented in this chapter. As previously mentioned, the finds are categorized by skeletal area; skull, torso and shoulder girdle, hands, upper limbs, pelvic girdle, and lower limbs.

4.1 Results physical anthropological research: population under study

In this paragraph, the results of the physical anthropological research will be presented. Not all results will be mentioned; the reader is referred to the catalogue physical anthropological reports (appendix I) to consult the detailed data on all individuals under study. In this catalogue, each individual is presented separately; aspects such as pathological remarks and details on the sex and age assessments will be presented.

Using the methods described in chapter 3, in total 48 find numbers, therefore also assuming 48 individuals were analysed. However, after the final physical anthropological analysis, the number of individuals that were analysed was set to 49; material with the find number 6205 appeared to be from two individuals instead of one.

All of the individuals were placed in a category (for example adult-female) to provide a general description per age and sex. For the categories 'child' and 'juvenile' the only criterion was age; meaning all individuals below 12 were categorized as 'child' and all individuals between 12 and 21 (before reaching biological/skeletal adult age) were categorized as 'juvenile'. A definite sex assessment could not be made for the individuals in the 'juvenile' category, though it was taken into consideration either male or female traits might be already visible and possible to determine. When this was possible, the probable sex assessment was noted. Though all individuals were already placed in an age and sex category during the excavation (which was used for making the research selection, as described in chapter 3), the sex and age estimations after analysis did not always correspond. There is variation in the preservation and conservation between the 48 individuals. This resulted in individuals which could only be categorized as 'adult' or, as for one individual, completely unknown.

4.1.1 Males

The sex category 'male' contained 15 individuals. Three of these individuals were documented as 'male?', these individuals were also included in the 'male' sex category. As mentioned before, the field sex estimation did not always correspond with the final sex estimation, resulting in excluding and including individuals from other categories. After the physical anthropological research, four individuals with the field sex estimation of male were eventually included in the female category (individuals with find number 1796, 2403, 3974, and 5931), and one individual with the field sex estimation of 'male?' was also included in the female category (individual with find number 1100). In addition, three individuals with the field sex estimation of female had after analysis a male sex estimation. Also, find number 6205, of which analysis indicated that the material was from two individuals, was included in this category as specific skeletal elements and regions indicate a male individual. With these changes, the final male category consists of 13 individuals. In table 4.1 the results of the male category are presented; this includes the find number, estimated age, sexualization degree and further physical anthropological data.

Table 4.1: overview of the physical anthropological data for the (probable) male category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	krn_nr	agecat	sex	degree pelvis	degree skull	age min	age max	AMstat (cm)
899		A	M	+1	+0,65	43,75	55,25	171,3 ±3,27
1024		A	M	+0,09	+0,875	54	60	170,6 ±3,27
1260		A	M	possibly male	+0,24	42,33	48,33	162,85 ±4,05
1694		A	M	+0,26	+0,69	52	61	171,1 ±3,27
1831		A	M	+0,84	+1,1	44	50	170 ±3,27
1835		A	M	+0,1	+0,33	33,33	39,33	164,62 ±2,99
1875		A	M	+0,5	+0,88	48	57	0
3087		A	M	+0,14	+0,53	20	25	167,55 ±3,27
3426		A	M	+1,47	+0,68	46,5	51,5	183,02 ±3,27
4139	4139	A	M	+0,58	+0,68	50	65	178,86 ±4,05
4883		A	M	+1	+0,65	39	44	175,17 ±3,27
4889		A	M	+1,25	+1,03	41	58	171,47 ±4,05
6205.2		A	M	not possible	+1,05	0	0	0

The results in the table indicate that the sex estimation was not always definite male; the sexualization degree ranges from +0,09 to +1,47 for the pelvis, and from +0,24 to +1,1 for the skull. The individuals with a sexualization degree lower than +1 have a sex estimation of a 'probable male', but are still included in the adult-male category. However, even though the sexualization degree of the pelvis is the most reliable sex indicator, three individuals (1024, 1835, and 3087) have a sexualization degree lower than or equal to +0,1. These individuals, though still placed in the male category, have no conclusive sex estimation. In addition, for most of the individuals the sexualization degree of the skull is not conclusive as well.

DNA was sampled for 4 individuals in this category; these were the individuals with find number 899, 1694, 3087, and 3426. The DNA results corresponded with the sex estimation of these individuals. For the individuals with find number 1694 and 3087, which both had a sexualization degree that ranged between indeterminable and probably male, the DNA is conclusive. However, DNA sampling of an individual placed in the juvenile category (estimated age-at-death was 12-16 years, so no sex estimation was made) indicated that this individual was male (individual with find number 3515). However, as the categories are based on age estimations, this individual was placed in the juvenile category instead of the male category.

The age estimations of the male individuals do not indicate a specific age-at-death representation in the selection. With the exception of one young individual, find number 3087 (age estimation: 20-25 years, also included in the young adults category), the age range represented is between 30-60 years. However, the majority of the individuals (n=9) fall in the upper end of this range; 40 years and older.

4.1.2 Females

In the preliminary selection for the female category, 14 individuals were selected. Individuals documented as 'F?' (female?) and 'F/J?' (female/juvenile?) were also included (n=3). After analysis, for only one individual documented as 'F/J?' was the final sex estimation female; two other individuals were placed in a different category (sub-adult and indeterminable). Two individuals documented as female in the preliminary selection were after analysis placed in the indeterminable category (find numbers 3797 and 4891); for these individuals not enough sex indicators were present to estimate sex. Also, one individual documented as female in the preliminary selection was after analysis included in the sub-adult category (individual with find number 1773; age between 14-18 years); in addition, one individual in the sub-adult category was after the final analysis placed in the femalte category (individual with find number 1927). Furthermore, one individual was placed in the indeterminable category (see 4.1.4), and material from find number 6205 also indicated a female individual. The results of the female category, a

total of 17 individuals, are presented in table 4.2, again including age estimates, sexualization degree, and further remarks.

Table 4.2: overview of the physical anthropological data for the (probable) female category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	krn_nr	agecat	sex	degree pelvis	degree skull	age min	age max	AMstat (cm)
912		A	F	-0,4	-0,44	25	34	157,84 ±3,72
1100		A	F	-1	-0,83	36,33	42,33	164,4 ±4,24
1333		A	F	-0,68	-0,01	51,67	57,67	157,17 ±3,55
1377		A	F	-0,4	-0,25	51	60	155,12 ±3,72
1695		A	F	-1,3	-0,7	20	26	151,17 ±3,72
1796		A	F	-1	-0,45	52	61	0
1887		A	F	-1,42	-0,75	61	66	159,7 ±3,55
1927		A	F	-1,16	not possible	50	59	160 ±3,72
2366		A	F	-0,6	+0,47	37	46	167,72 ±3,72
2403		A	F	-0,84	-0,1	20	30	167,48 ±3,51
3797	3791	A	U (F based on DNA)	not possible	-0,16	21	??	0
3974		A	F	-0,9	0	37,33	43,33	165,5 ±4,45
4453	5355	A	F	not possible	-0,07	40	80	0
5931	5919	A	F	-1	+0,09	37,33	43,33	178,93 ±4,45
6749	6748	A	F	-0,75	-0,47	25	34	155,41 ±4,24
6786	6787	A	F	not possible	-0,47	30	60	0
6205.1		A	F	-1	not possible	25	43	0

Again, in this category the sex estimation was not always conclusive. The sexualization degree ranges from -0,4 to -1,42 for the pelvis, and from 0 to -0,83 for the skull. Remarkably, the sexualization degree of the skull for the females in this selection is not very convincing; some individuals estimated to be female have a slightly male skull (e.g. individual with find number 5931) or have a sexualization degree close to indeterminable (i.e. 0). Individual with find number 5931 had an inconclusive sex estimation, but was, based on the sexualization degree of the pelvis, estimated to be a female.

In this category, DNA was sampled for 4 individuals, these were the individuals with find number 1100, 1887, 3797, and 3974, and the DNA results corresponded with the sex estimation based on skeletal indicators. As the sex estimation of individual with find number 3797 (age estimation was adult, at least older than 21 years) resulted in unobservable due to preservation, DNA contributed to estimating the sex of this individual. This resulted in adding this individual to the female category.

For the individuals in the female category, there also appears to be no specific age-at-death representation. Though a few 'younger' individuals are present, the age-at-death estimations indicate mostly individuals older than 35 years. In contrast to the males, it would seem that more 'older' individuals are present in this category. In total, 5 individuals are estimated to be at least older than 50 years, whereas for the males there are only three individuals in this age range. It is possible that this is due to the usage of different age estimations methods.

4.1.3 Young adults and sub-adults

The category sub-adults is a combination of the individuals documented as 'J-U' (juvenile, sex indeterminable) or 'Ch-U' (child, sex indeterminable), separated based on age as mentioned in chapter 3. The young adults include all individuals between 21 and 30 years. All individuals documented as 'Ch' in the preliminary selection were still in the child category after the final analysis (n=10); observations during the excavation regarding the age of the individual (very young) was, obviously, easier than the field sex estimations. However, one individual was added to the child category, individual with find number 6478. This individual was documented in the field selection as 'F/J?' but analysis indicated an individual between 3-5 years. In total the child category consists of 11 individuals. For the juvenile category, the preliminary selection contained 6 individuals. One individual was placed in the female category after analysis, and one individual from the female category was placed in the juvenile category (as explained in the previous paragraph); this did, of course, not affect the final number of individuals in the juvenile category. Both the results of the child and juvenile category are presented in table 4.3.

Table 4.3: overview of the physical anthropological data for the child and juvenile category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates.

vnr	krn_nr	agecat	sex	probable sex	age min	age max
1205		J	U	female traits, broad mandible	14	19
1773		J	U	possible female	14	16
2009		J	U	indifferent	12	16
3515		J	U	male, based on DNA	12	16
5830		J	U	possible female	13,5	16,5
5917	5918	J	U	possible female	18	24
1707	1707	Ch	U		1,3	2,6
2243		Ch	U		2	4
2278		Ch	U		6	10
2611		Ch	U		7	11
3290		Ch	U		6	10
6211	6271	Ch	U		7,5	12,5
6260	6361	Ch	U		0	1
6373	6392	Ch	U		1	2,8
6451	6453	Ch	U		5	9
6476	6470	Ch	U		0,5	2,5
6478	6479	Ch	U		3	5

The category for young adults consists of 6 individuals, which are individuals from the male, female, and juvenile category. These individuals are highlighted because of this study, and because, though most of these individuals are already included in the 'adult' category, the age estimations of these individuals are between the juvenile category and the mature adult category.

In total, there are 4 young adults with a female sex estimation. Two of these individuals have an age-at-death estimation between 25-34 years; the other two individuals have an age-at-death estimation between 20-30 (for one individual this range is estimated to be 20-26). As for male young adults, there is only one individual present. This individual has an age-at-death estimation of 20-25 years. Lastly, there is one young adult individual (age-at-death estimation between 18-24 years) with no definite sex estimation; sex indicators which are present (pelvis) do indicate to a female individual. The results of the young adult category are presented in table 4.4, with sexualization degree, age-estimations, and further remarks.

Table 4.4: overview of the physical anthropological data for the young adult category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	krn_nr	agecat	sex	degree pelvis	degree skull	age min	age max	AMstat (cm)
912		A	F	-0,4	-0,44	25	34	157,84 ±3,72
1695		A	F	-1,3	-0,7	20	26	151,17 ±3,72
2403		A	F	-0,84	-0,1	20	30	167,48 ±3,51
3087		A	M	+0,14	+0,53	20	25	167,55 ±3,27
5917	5918	J	O	possible female		18	24	0
6749	6748	A	F	-0,75	-0,47	25	34	155,41 ±4,24

4.1.4 Indeterminable individuals

In total three individuals were, after analysis, documented as 'A-U'; meaning adult individuals but no further indications on sex or specific age were present. All of these three individuals, find numbers 6589, 4891, and 3797, were poorly preserved and very fragmented. All of these individuals were documented in the preliminary selection as 'female'. However, due to fragmentation and the conservation of the material, no indicators to estimate sex were present, or to estimate a more specific age than 'adult'. Individual with find number 6589 had also no finds documented during the physical anthropological analysis, though documented in the field with a funerary headdress; whereas some green oxidation was present on individual with find number 4891. For individual with find number 3797 a funerary headdress was also documented. As previously mentioned, DNA sampling resulted in a sex determination of individual with find number 3797, adding this individual to the female category. The other two individuals still have no definite sex estimation and the age estimations have a broad interval (between 21-80 years).

4.1.5 Individuals with 'crown numbers'

In light of this study, and the material analysis which will be discussed in the subsequent paragraph, the individuals with the 'crown numbers' were highlighted (table 4.5). The 'crown numbers' are find numbers given to the finds around the skull of that specific individual, often fragments of the funerary headdress or similar finds. These finds will be discussed later, but the table below presents the physical anthropological data of the individuals of which a funerary headdress, or at least a part of this decoration, was excavated, documented, and analysed.

Table 4.5: overview of the physical anthropological data for the individuals with a crown number. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	krn_nr	agecat	sex	age min	age max	AMstat (cm)
6260	6361	Ch	U	0	1	0
6476	6470	Ch	U	0,5	2,5	0
6373	6392	Ch	U	1	2,8	0
1707	1707	Ch	U	1,3	2,6	0
6478	6479	Ch	U	3	5	0
6451	6453	Ch	U	5	9	0
6211	6271	Ch	U	7,5	12,5	0
5917	5918	J	U	18	24	0
3797	3791	A	U (F based on DNA)	21	??	0
6589	6591	A	U	21	??	0
6749	6748	A	F	25	30	155,41 ±4,24
6786	6787	A	F	30	60	0
5931	5919	A	F	37,33	43,33	178,93 ±4,45
4453	5355	A	F	40	80	0
4139	4139	A	M	50	65	178,86 ±4,05

As is observable in table 4.5, this highlighted selection of individuals consists of more 'young' individuals than 'old' individuals. In total, there are seven individuals which are placed in the child category; ages are between 0 years (around birth) and 12,5 years. It would seem that no individuals from the juvenile category are in this selection; though the upper estimated age range for the individual with find number 6211 can be considered 'juvenile'. Furthermore, though the individual with find number 5917 is categorized as 'J', this individual is, based on the age estimation, considered to be a young adult (as was mentioned in the previous paragraph). Seven individuals in this selection are adults; 5 are female, one individual is male, one is unknown. The age estimations for the adult individuals have, however, a broad range as this could not be fully analysed due to preservation. However, one individual appears to be a young adult; the individual with find number 6749.

4.1.6 Summary and overview

To provide an overview of the previously discussed data regarding the physical anthropological analysis, figure 4.1, 4.2, and 4.3 illustrate the distribution of young and adult individuals, as well as females and males, in the selection under study. Figure 4.1 provides an overview of all the young individuals under study (n=22); divided per age category.

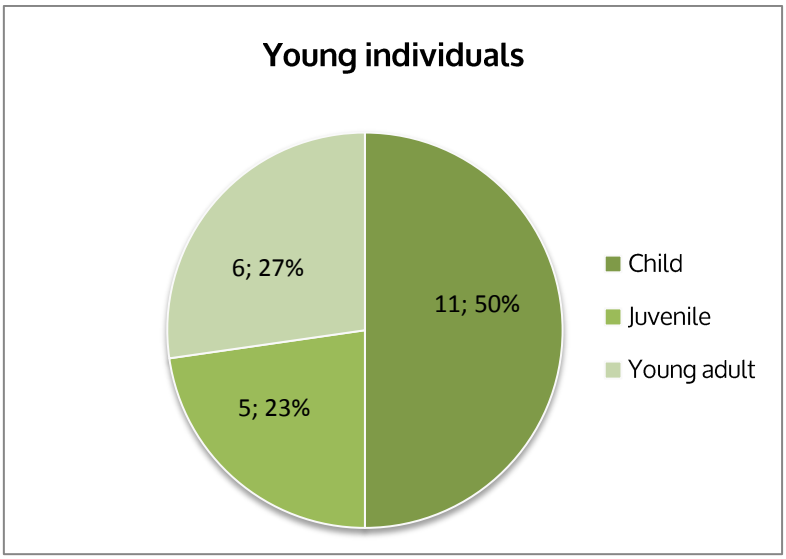

Figure 4.1: overview of the young individuals under study, sorted by the age categories child, juvenile, and young adult.

Figure 4.2 illustrates the same distribution of young individuals as presented in figure 4.1; however, the adult individuals under study (n=27) are added.

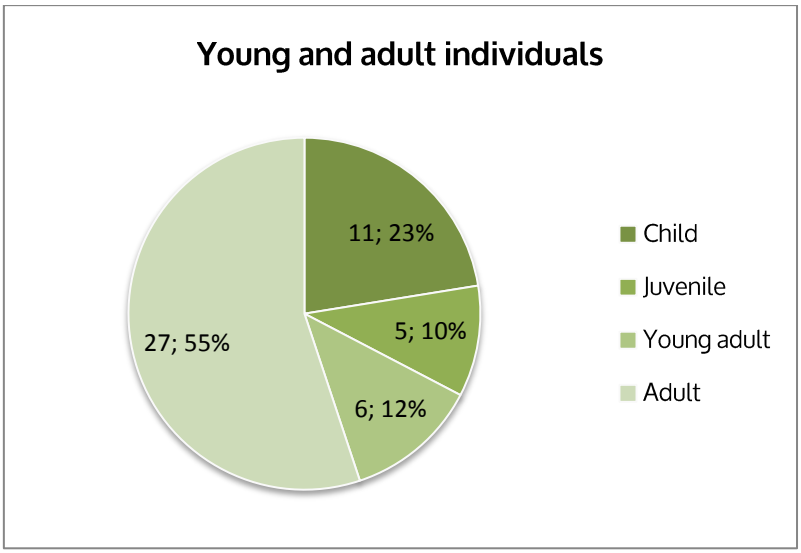

Figure 4.2: overview of all age categories represented in the individuals under study.

Figure 4.3 illustrates the distribution of female and male individuals under study. Note that this also includes individuals from the young adult category (as sex estimation was possible) and the individual with find number 3797 (as DNA was available). Total number of adult individuals with a sex estimation in the selection under study is 30.

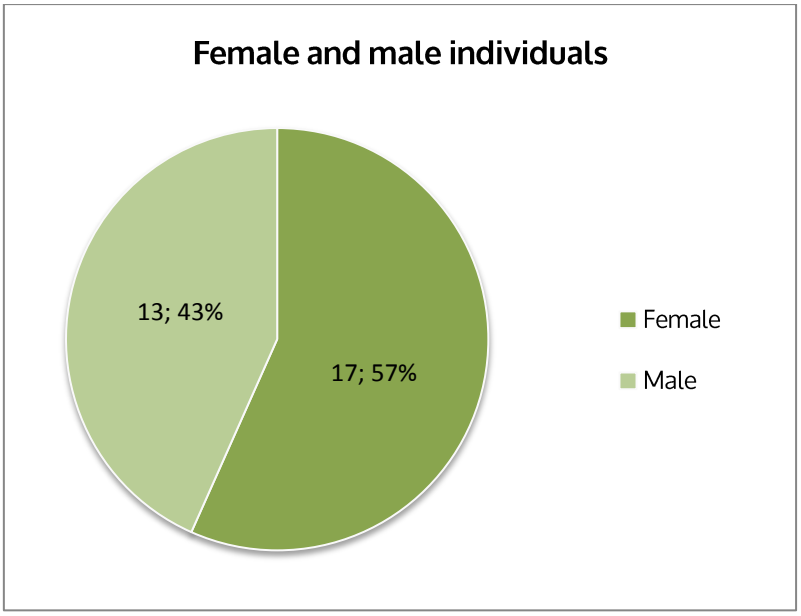

Figure 4.3: overview of the female and male (sex estimations) individuals under study.

4.2 Results material analysis

As previously mentioned, any finds that were present with an individual were documented and analysed; this also includes the green discoloration on bone. The results of the material analysis and discolorations on bone(s) will be presented below. Finds placed in a specific skeletal area (e.g. skull) were either observed on bone, or were present in the soil residue of that specific skeletal area. Each finding, whether it was a discoloration on the bone or a find/artefact, was documented and stored in the database as described in chapter 3. The database holds a total of 239 records for discolorations and finds.

4.2.1 Skull

The skeletal area of the skull had a specific focus in this study for finds and discolorations. Especially for the individuals for which a crown number was also present both 'loose' finds (residue in the soil) as well as *in situ* material (still present on bone) were expected. In total, the database contains 153 records for finds and discolorations on the skull. This includes multiple finds on the same individual; filtering these data results in a total of 44 individuals with finds on/near or discolorations on the skull. This high number of individuals was of course expected, as the selection of individuals was based on the presence of discolorations on the skull. It is, however, remarkable that not for all 49 individuals discolorations or finds for the skull were documented. These five individuals are find numbers 3426, 6476, 6589, 6205.1, 6205.2. No finds were documented at all on the first three individuals, which will be discussed in paragraph 4.2.7. Table 4.6 presents the skull regions and the total number of individuals for which these regions could be inspected for (green) discoloration(s).

Table 4.6: overview of the skull regions and the total number of individuals which could be inspected.

Skull region	Number of individuals inspected
Frontal	43
Parietal L	40
Parietal R	42
Temporal L	33
Temporal R	40
Occipital	38
Maxilla L	28
Maxilla R	25
Orbit/Zygomatic R	16/21
Orbit/Zygomatic L	17/27
Mandible	37

4.2.1.1 Discolorations on bone

Green discoloration on skull elements is present for 41 individuals, documented on a total of 119 locations. The most often occurring location for green discoloration on the skull is the frontal (documented for 9 individuals; 13 times). It occurs most frequently on the central of the frontal (for 7 individuals; 8 times). Another frequently occurring location is the parietal, though it appears to occur more frequently on the right parietal than the left parietal for individuals (left = 10 individuals, 10 times; right = 8 individuals, 12 times); this skull region could, however, also be inspected more often (table 4.6).

A few notable combinations of locations with green discoloration were observed during this analysis. In total, three combinations of locations were observed, which were indicated by a pattern number:

1) forehead/frontal and the area of the parietals (including skeletal elements near the parietals, such as the temporals, sphenoids);
2) on top of the skull (sagittal suture/coronal suture) and the area of the parietals (also including skeletal elements near the parietals);
3) occipital and the area of the parietals (again, also including skeletal elements near the parietals).

However, some individuals were exceptions and could not be documented with these patterns numbers or had green discoloration in remarkable areas. Additionally, two more pattern numbers were appointed:

4) green discoloration enclosing the complete skull (frontal, parietal, and occipital)
5) green discoloration in the area of the mouth (maxilla, teeth, and mandible)

1: Frontal/forehead and parietals area
As mentioned, one of these observed patterns is the presence of green discoloration on the forehead (or areas near the frontal; e.g. orbits) and the parietals-temporals area. In total 6 individuals were documented with green discoloration on these locations of the skull (table 4.7), however, there is variation in the specific location with green discoloration between individuals.

Remarkably, only one individual was documented with green discoloration on both orbits (and other areas), which was find number 1694 (fig. 4.1); the other individuals had green discoloration on only one of the orbits (and other areas).

Table 4.7: overview of the individuals with pattern frontal/forehead and parietals area.

Find number	Type residue	Category	Skeletal element
1024	green	skull	frontal, sphenoid-frontal R
1694	green	skull	frontal, frontal-parietal R, orbit L+R, parietal R, sphenoid L, mandible
2009	green	skull	frontal, temporal L
2243	green	skull	frontal, temporal-parietal R, parietal L, zygomatic R, orbit L, mandible
3087	green	skull	sphenoid R, orbit L
6373	green	skull	frontal, left parietal

This specific pattern was at least visible in 2 individuals; find number 1694 and 2243 (fig. 4.4 and 4.5a, b, and c). The green discoloration documented for the individual with find number 1694 was substantial (fig. 4.4) and distinct; for the individual with find number 2243 it was less prominent.



Figure 4.4: green discoloration on both orbits and multiple areas on the frontal (left) as well as the right parietal (right) of the individual with find number 1694. Circular, round of shape; both small and large areas. Other skeletal elements with green discoloration not displayed.



Figure 4.5a: green discoloration on the left orbit (left) and frontal (right) of the individual with find number 2243. Diffuse, large area.



Figure 4.5b: green discoloration on the left parietal of the individual with find number 2243. Concentrated, small area.



Figure 4.5c: green discoloration on the right parietal-temporal area of the individual with find number 2243. Diffuse, small area.

The other individuals presented in table 4.7 were documented with green discoloration near the forehead (i.e. orbits) and the sphenoid-temporal area. Though still included for the frontal/forehead-parietals pattern, there were no specific similarities with the aforementioned individuals. The locations documented for the individual with find number 1024 were limited and may be correlated; therefore only indicating to a possible pattern. Each discoloration was a small, concentrated area. This was similar for the individual with find number 3087; limited locations of green discolorations were present, but still indicative of this possible pattern. The individual with find number 2009 had also limited locations but were substantial in size (located centrally and a large area of green discoloration, fig. 4.6). Additionally, the individual with find number 6373 was documented with green discoloration on the frontal and the left parietal; it was also documented on a few indeterminable skull fragments. The green discolorations on these regions were present in oval-shaped patterns (fig. 4.7).



Figure 4.6: green discoloration on the frontal of the individual with find number 2009. Large, round area. Green discoloration on the left temporal not displayed.

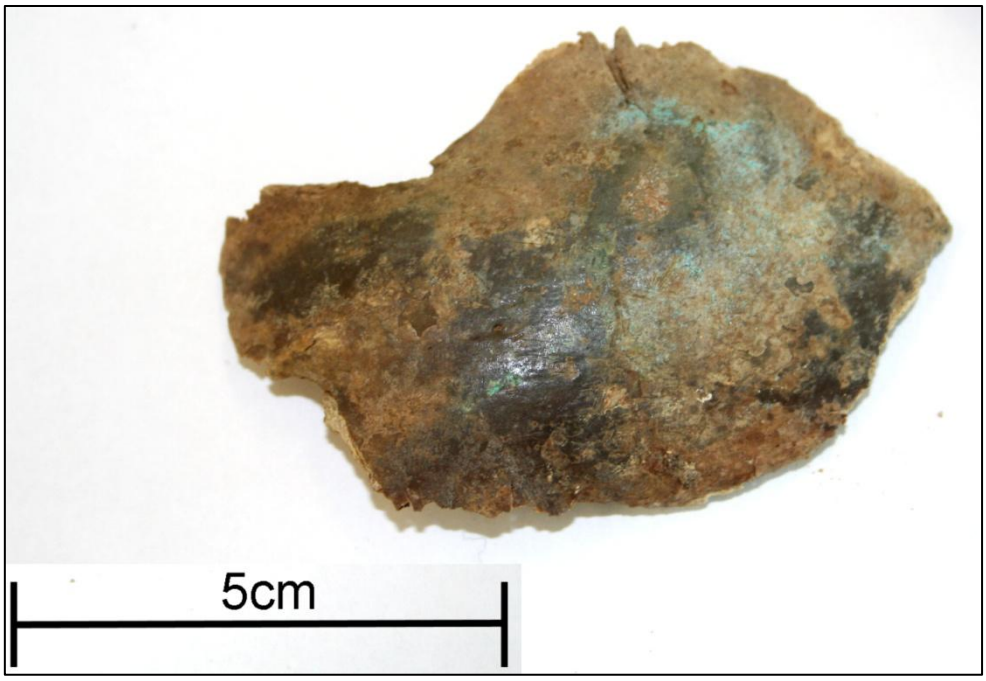

Figure 4.7: green discoloration on the frontal of the individual with find number 6373. Note the oval-shaped green discoloration; rest is diffuse. Green discoloration on the left temporal not displayed.

2: On top of the skull and parietals area

Another pattern observed in the locations of green discoloration were the locations of both parietals (and areas near the parietals) and on the top of the skull (sagittal suture) (table 4.8). For individual with find number 1260, green discoloration was documented on the left frontal-parietal area (near the top of the skull), as well as on the right sphenoid, and both temporals (fig. 4.8a, b, c).

Table 4.8: overview of the individuals with a pattern on top of the skull and parietals area.

Find number	Type residue	Category	Skeletal element
1260	green	skull	frontal-parietal L, temporal L+R, sphenoid R
1695	green	skull	sagittal suture, parietal L, orbit L
1875	green	skull	sagittal suture, temporal L, parietal L+R
1887	green	skull	sagittal suture, frontal-parietal L+R



Figure 4.8a, b, c: up-left (a): green discoloration on left temporal (individual 1260). Up-right (b): green discoloration on the right temporal (individual 1260). Down (c): green discoloration on the frontal-parietal transition (individual 1260). All are small, diffuse areas.

However, this specific pattern was more visible for the individuals with find number 1887, 1875, and 1695. For these individuals the amount of green discoloration was also more than documented for individual with find number 1260. In addition, the green discoloration on top of the skull for these individuals is located more posteriorly than documented for individual with find number 1260.

The locations of green discoloration for individuals with find number 1887 and 1875 are similar (fig. 4.9a, b, c, and 4.10). The individual with find number 1695 has slightly similar locations with green discoloration as the aforementioned individuals, but was less well preserved (fig. 4.11). For the individual with find number 1875 both temporals had green discoloration as well (close to the correlating parietal; fig. 4.10).



Figure 4.9a, b, c: green discoloration on top of the skull and both parietals of the individual with find number 1887. Up (a): sagittal suture; down-left (b): left parietal-temporal; down-right (c): right parietal-temporal. All are large, oval areas.

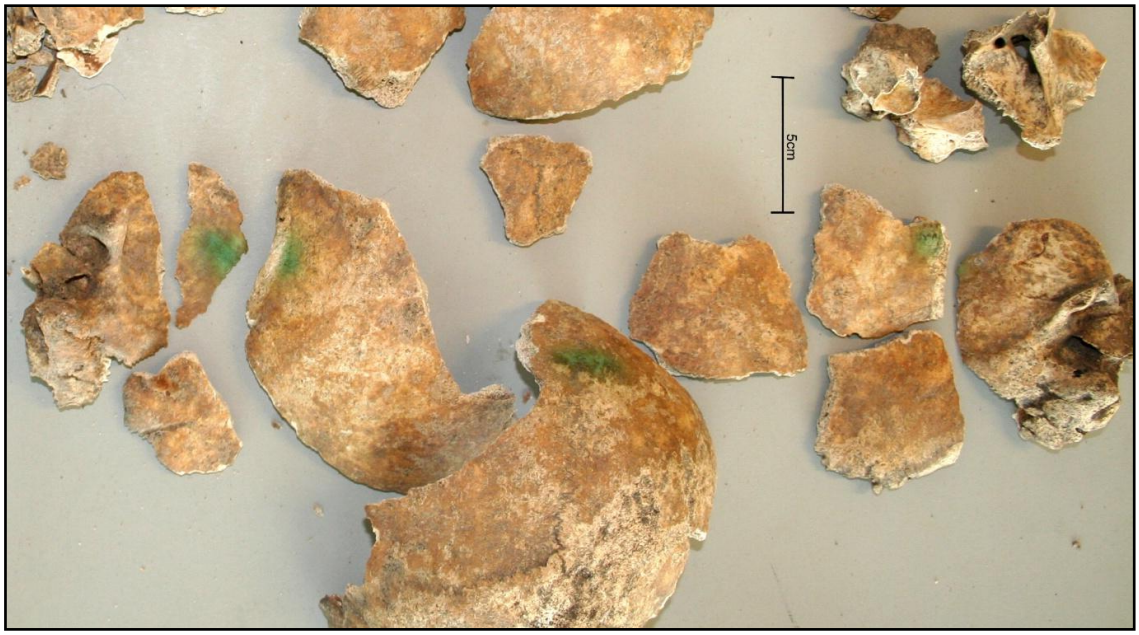

Figure 4.10: green discoloration on both parietals-temporals and on top of the skull of the individual with find number 1875. Left is the left temporal-parietal; middle is the sagittal suture; right is the right temporal-parietal. All are small, oval areas and diffuse.



Figure 4.11: green discoloration on both parietals (on sagittal suture) and the left orbit of individual with find number 1695. Left is the frontal; right-above the right parietal and right-down the left parietal. All areas are diffuse and large.

3: occipital and parietals area

Another observed pattern in the locations with green discoloration was that of the occipital and the parietals area (table 4.9). Remarkably, the occurrence of green discoloration on the frontal simultaneously with green discoloration on the occipital was infrequent (see pattern 4); though both these locations were documented frequently in combination with green discoloration on the parietals.

In total, 5 individuals were documented with this pattern type. Two individuals were documented with green discoloration on both parietals and the occipital; individuals with find number 1927 and 5917. For the individual with find number 1927, the green discoloration on both parietals is located on top of the skull (fig. 4.12a, b); for individual with find number 5917 the parietals had green discoloration more central (most lateral sides).

The individual with find number 1377 was documented with green discoloration on the occipital and left parietal, as well as the right temporal (fig. 4.13a, b; left parietal not displayed). The individual with find number 4883 was documented with green discoloration on the occipital and only the right parietal. In addition, this individual had also green discoloration on left sphenoid (inferiorly), and also the left maxilla. The last individual with green discoloration in the area of the occipital-parietal is find number 4453. This individual had green discoloration on the occipital and right temporal.

Table 4.9: overview of the individuals with a pattern on the occipital and parietals area.

Find number	Type residue	Category	Skeletal element
1377	green	skull	parietal L, temporal R, occipital
1927	green	skull	parietal L+R, occipital
4453	green	skull	temporal R, occipital
4883	green	skull	maxilla L, sphenoid L, parietal R, occipital-parietal R, occipital
5917	green	skull	parietal L+R, occipital



Figure 4.12a: green discoloration on both parietals (on sagittal suture) of the individual with find number 1927. Left is anterior, right is posterior. Small, concentrated, oval area.

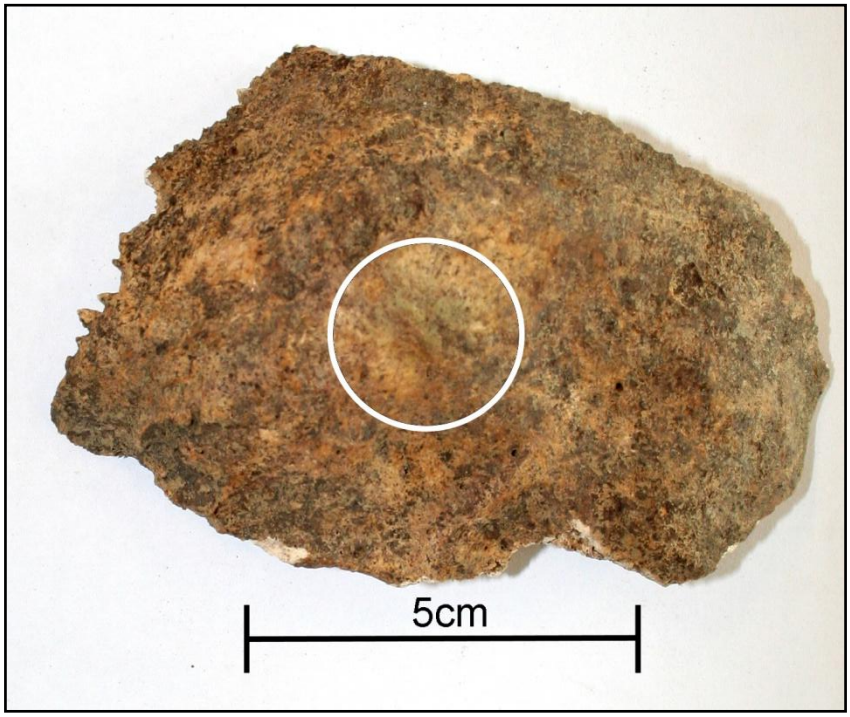

Figure 4.12b: green discoloration on the occipital of the individual with find number 1927. Up is superior, down is inferior. Small, round area.

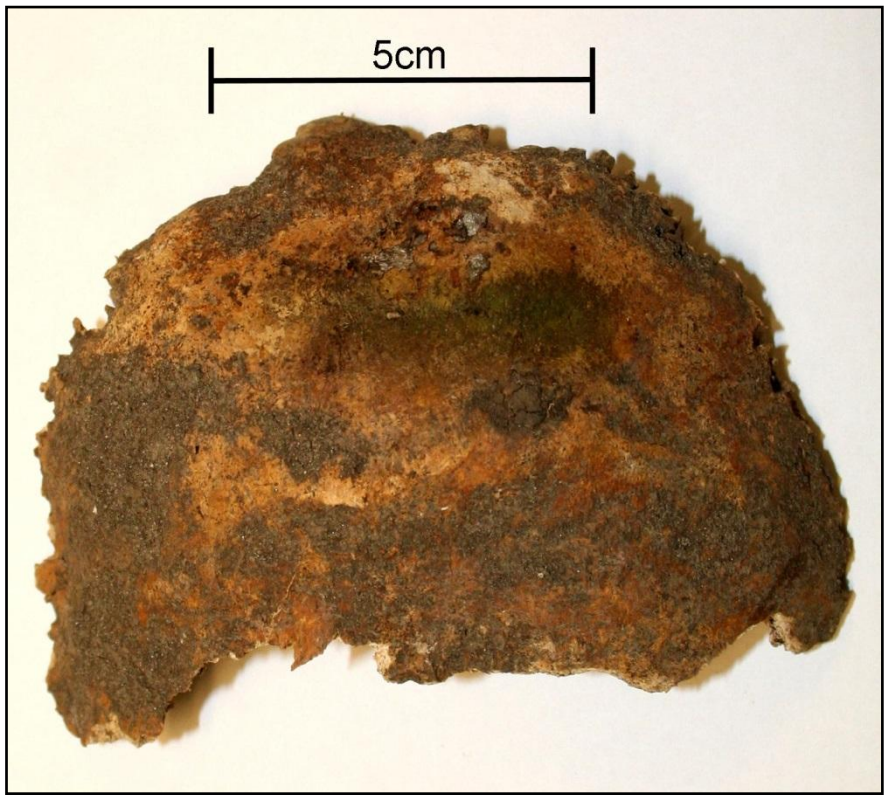

Figure 4.13a: green discoloration on the occipital of the individual with find number 1377. Up is superior, down is inferior. Area is a large oval, almost rectangular.



Figure 4.13b: green discoloration on right temporal of the individual with find number 1377. Small, concentrated, round area.

4: frontal, parietal, and occipital area

The last observed distinct pattern was that of the frontal, parietal, and occipital area. This pattern appears to be infrequently present, as this was only documented for two individuals; find number 3797 and 6786 (table 4.10) The green discolorations on the skull of individual with find number 3797 were relatively small in size, but on concentrated areas (fig. 4.14). Larger areas of green discoloration on similar locations were documented for the individual with find number 6786 (fig. 4.15a, b, and c). It should be noted, however, that for the individual with find number 6786 this was less visible than for the individual with find number 3797. Though the skull was fragmentary for both individuals (fig. 4.14 and fig. 4.15a, b, and c), it was possible to reconstruct most of the skeletal elements. Both individuals were documented with a crown number, which will be discussed in paragraph 4.2.9. Additionally, the green discoloration documented for the individual with find number 6786 was present in relatively large areas and both ectocranially as well as endocranially.

Table 4.10: overview of the individuals with a pattern on the frontal, parietals, and occipital.

Find number	Type residue	Category	Skeletal element
3797	green	skull	frontal, parietal L+R, temporal R, lambdoidal suture
6786	green	skull	frontal, orbit R, parietal R, occipital

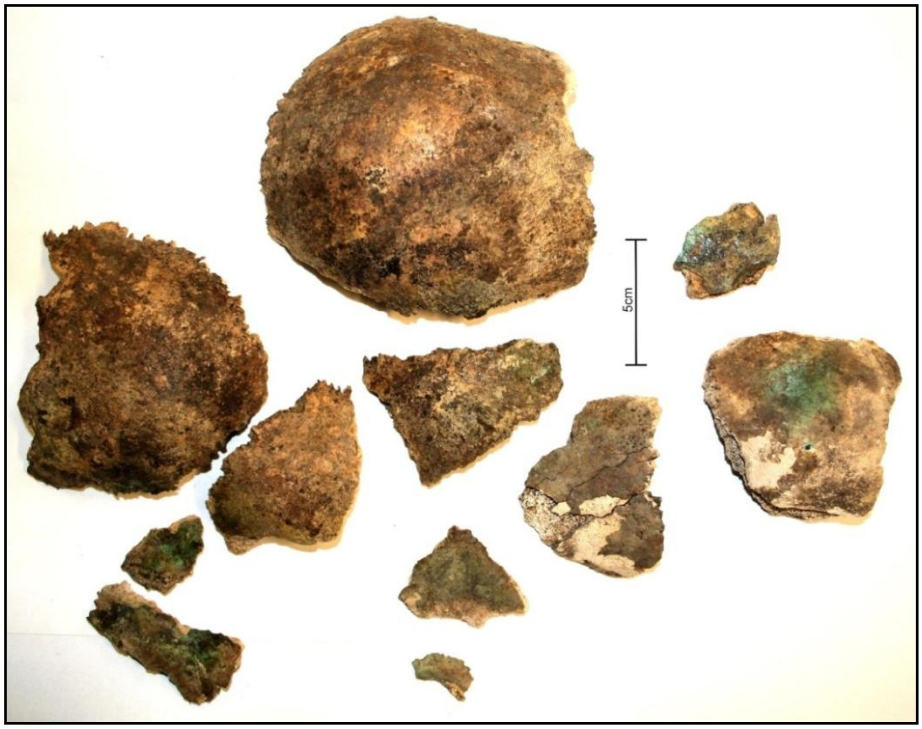

Figure 4.14: green discoloration on the frontal (right), parietals (middle) and occipital (left) for the individual with find number 3797. Small, diffuse areas; some areas are concentrated.

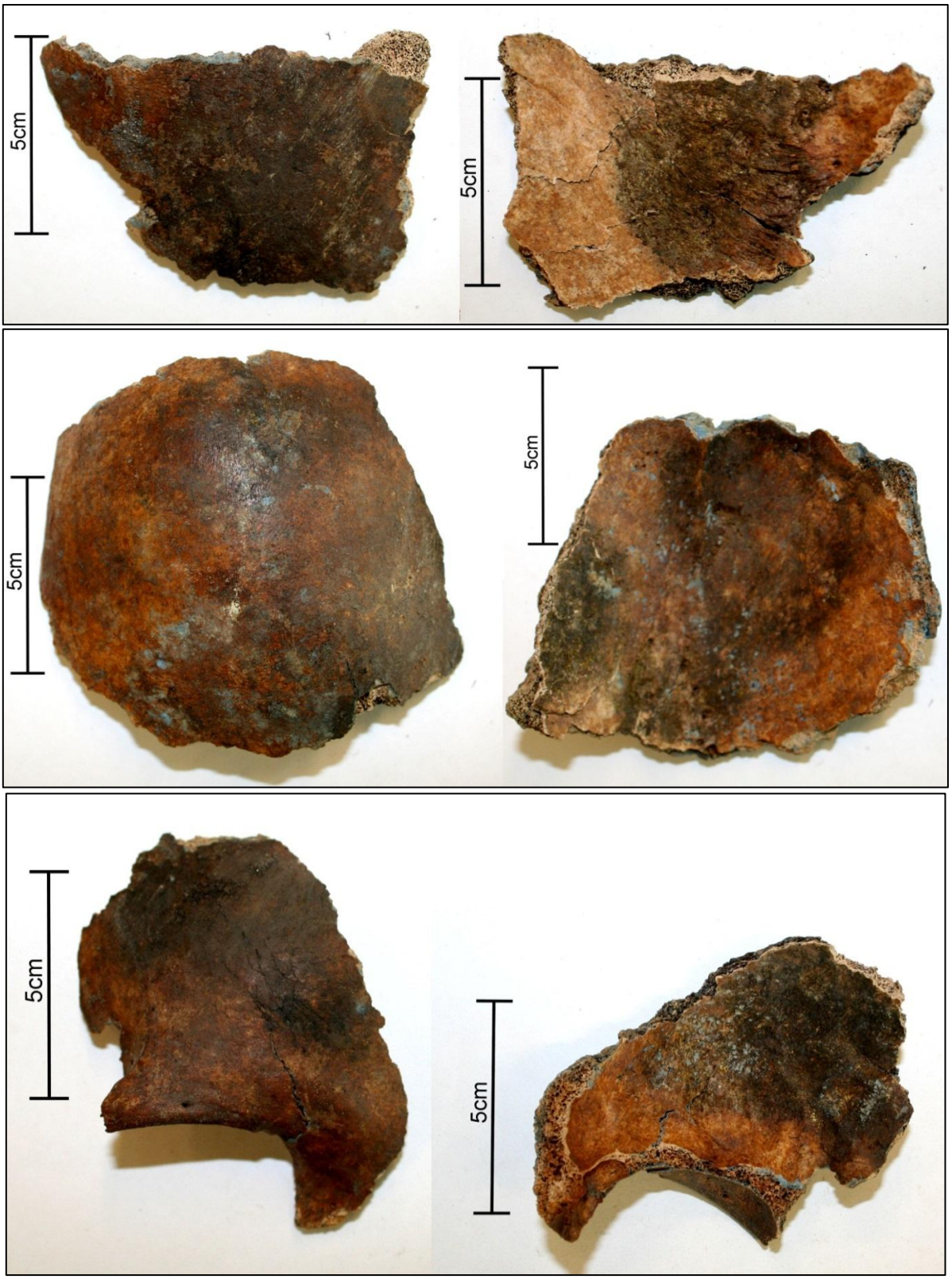

Figure 4.15a, b, c: first row (a): green discoloration on parietal/sagittal suture; left is ectocranial, right is endocranial (individual 6786). Middle row (b): green discoloration frontal; left is ectocranial, right is endocranial (individual 6786). Last row (c): green discoloration on right orbit; left is ectocranial, right is endocranial (individual 6786). All areas are large and diffuse.

5: area of the maxilla and mandible

A remarkable observation was the green discoloration on the posterior aspect of the mandible, or areas near this, for 5 individuals (table 4.11). Both the individuals with find number 1694 and 2243 were already mentioned, as these individuals were also documented with a specific pattern of green discoloration on the skull. Three other individuals, find numbers 2403, 3515, and 4891, were also documented with green discoloration on this area of the mandible (located anteriorly for individual with find number 4891). The individual with find number 2243 (fig. 4.16) was documented with a large area of green discoloration on the posterior aspect of the mentum. Individual with find number 4891 was, however, not well preserved and could not be further analysed. Individual with find number 2403 had besides the green discoloration on the mandible (fig. 4.17) only green discoloration on the spine (see paragraph 4.2.2). Furthermore, individual with find number 3515 had besides the green discoloration on the mandible (roots lower teeth) also green discoloration on the left ilium (see paragraph 4.2.5), and for the skull area on the right orbit and right zygomatic. Lastly, the individual with find number 1694 had green discoloration on the tooth socket of the lower left second molar.

Table 4.11: overview of the individuals with discolorations in the area of the mouth.

Find number	Type residue	Category	Skeletal element
1694	green	skull	tooth socket of 3.7
2243	green	skull	posterior aspect of the mentum
2403	green	skull	posterior aspect of the mentum
3515	green	skull	tooth sockets and roots of teeth on lower left (mandible)
4891	green	skull	anterior aspect of the mandible, on mentum

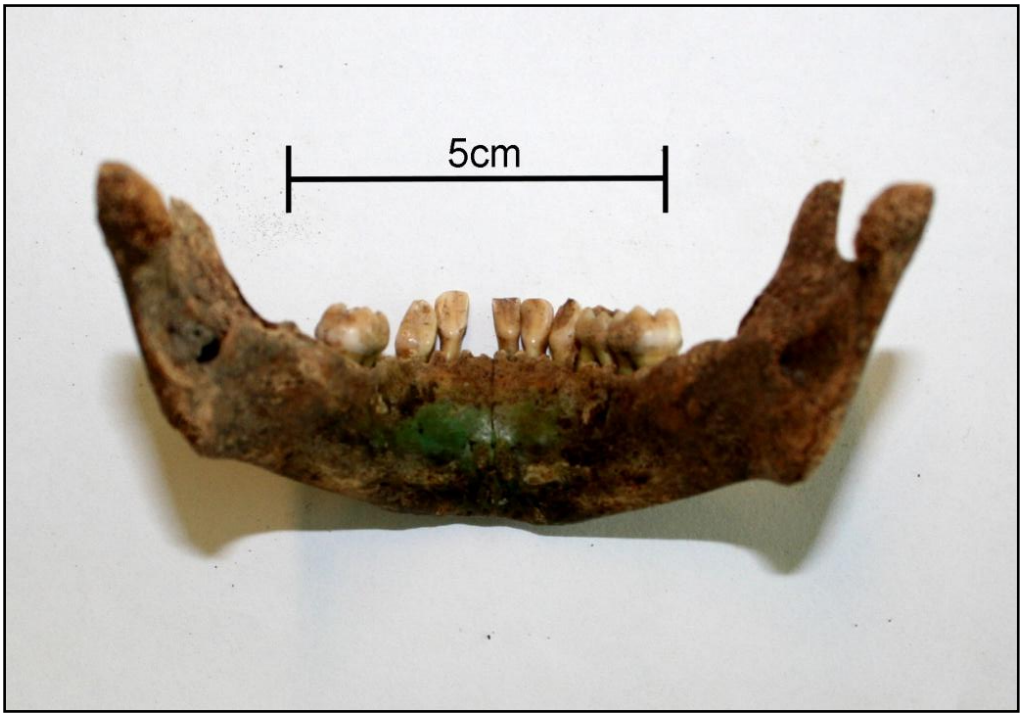

Figure 4.16: green discoloration on the posterior aspect of the mandible (individual 2243).



Figure 4.17: green discoloration on the posterior aspect of the mandible (individual 2403).

No observed patterns

The remaining individuals were documented with green discoloration on aforementioned locations; this was, however, not in a specific or distinct pattern as for the previously mentioned individuals. However, one individual (find number 1835) was documented with green discoloration on the parietal and on top of the skull; this would be indicative of the pattern 2. The observed green discoloration was documented in a straight line; from the top of the skull towards the posterior side of the skull (back of the head). As this was not very distinct, no definite conclusions regarding a pattern could be made. The other individuals with green discoloration on various locations are presented in table 4.12.

Table 4.12: overview of the individuals with no specific pattern of green discoloration.

Find number	Type residue	Category	Skeletal element
899	green	skull	orbit R, sphenoid R
912	green	skull	orbit L, mandible
1100	green	skull	maxilla R, temporal L
1835	green	skull	sagittal suture, parietal R, foramen magnum
2278	green	skull	temporal-parietal L, parietal L
3515	green	skull	orbit R, zygomatic R, dental/mandible
5830	green	skull	occipital-parietal R, zygomatic R

In total, 14 individuals were documented with only one location of green discoloration on the skull (table 4.13). Some of these individuals were poorly preserved; either indeterminable skull fragments had green discoloration (therefore, no location could be documented as it was entered into the database as 'indeterminable skull fragment') or poor preservation did not allow a full analysis. Additionally, a total of three individuals were also documented with only one area of green discoloration on the skull but no specific location was documented; these are not presented in table 4.13. These individuals, find numbers 1707, 3290, and 6260, were very fragmented and the area of the skull on which the green discoloration was present could not be further determined. However, the presence of only one or two locations of green discoloration on the skull did not always indicate less finds or locations of discolorations elsewhere; the individual with find number 5830 was documented with only green discoloration on the right occipital-parietal (fig. 4.18) and right zygomatic (not displayed), but both several finds on and near the skull were documented as well as multiple locations with green discoloration for the other skeletal areas.

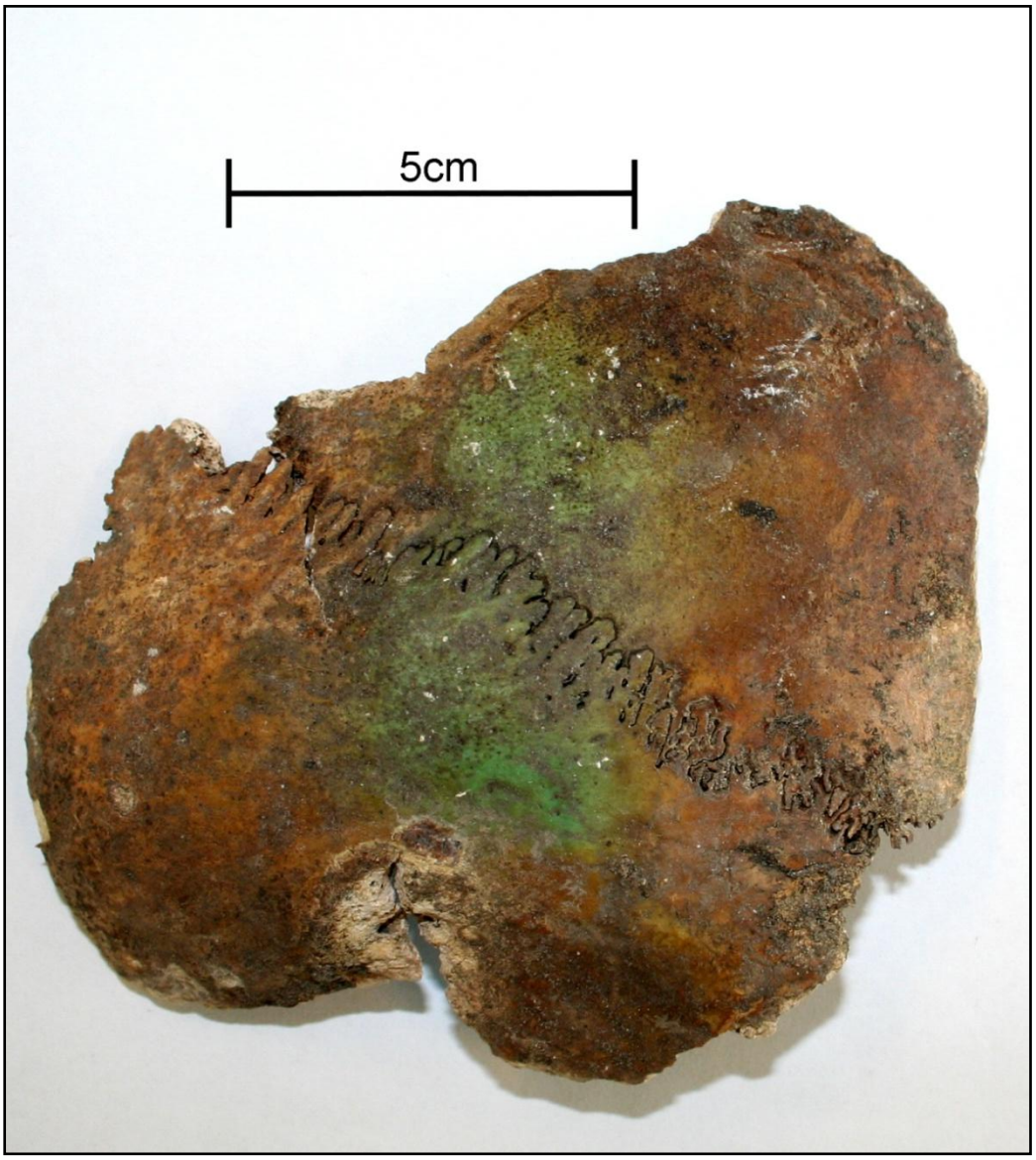

Figure 4.18: green discoloration on the right occipital-parietal (individual 5830). Large, diffuse area.

Table 4.13: overview of the individuals with only one location of green discoloration.

Find number	Type residue	Category	Skeletal element	Location
1205	green	skull	orbit R	superior
1333	green	skull	frontal	center
1773	green	skull	zygomatic R	center
1796	green	skull	orbit R	superior
1831	green	skull	occipital-parietal R	center
2366	green	skull	temporal-parietal L	center
2403	green	skull	mandible	posterior
2611	green	skull	frontal	right
3974	green	skull	temporal-occipital L	center
4139	green	skull	zygomatic R	posterior
4889	green	skull	parietal L	anterior
4891	green	skull	mandible	anterior
6211	green	skull	parietal L	center
6749	green	skull	frontal	Inferior

Other types of discoloration(s)

Another noteworthy observation was the amount of green discoloration endocranially in one individual; the individual with find number 6786, as previously mentioned. Endocranial green discoloration was observed in other individuals, but these were small areas and locally (i.e. 1100, 3290, 4139). For individual with find number 6786 the green discoloration on the endocranial surface was more prominent than on the ectocranial surface.

Blue discoloration occurs less on individuals; this is present for 6 individuals, documented on a total of 14 locations; all of these individuals were crown individuals. However, only 4 individuals also have green discoloration in combination with the blue discoloration (find numbers 4453, 6451, 6749, and 6786). The location of the blue discoloration, which was documented as a more diffuse discoloration, occurs mostly on parietals, occipital, and temporals. Only for two individuals does the blue discoloration occur elsewhere; i.e. on the frontal and locally on the sutures. All individuals documented with blue discoloration are presented in table 4.14, sorted by find number.

Table 4.14: overview of the individuals with blue discoloration.

Find number	Type residue	Category	Skeletal element
4453	blue	skull	sagittal suture, coronal suture, occipital
5931	blue	skull	parietal L+R, temporal R, temporal-parietal R
6451	blue	skull	parietal L+R, temporal R
6478	blue	skull	parietal R
6749	blue	skull	frontal
6786	blue	skull	on most skull elements; diffuse

4.2.1.2 Finds

Finds were documented per category, as described in chapter 3. For the body region of the skull, a total of 9 individuals were documented with find(s). A total of 19 finds were documented, divided over the categories of MXX, MCU, GLS, AW, iron residue, and OXX.

The database only holds two records for the metal (MXX) category. For one record, this is, however, a find that consists of three small metal elements that were found in the soil residue of individual with find number 5917. All three small metal elements are presumably fragments of a funerary headdress, as a crown number was documented with this individual. The elements are displayed in figure 4.19, 4.20, and 4.21. As is observable in the figures below, the elements consist of a single wire formed in a round shape at the end. Through this formed loop, similar formed wires are attached. In addition, a few metal fragments were also documented for this individual (not photographed); a few loose wire fragments and smaller, thicker oval shaped object.



Figure 4.19: metal element #1 found in the skeletal area of the skull for the individual with find number 5917. Inset is a detailed photograph to illustrate this decorative metal element.

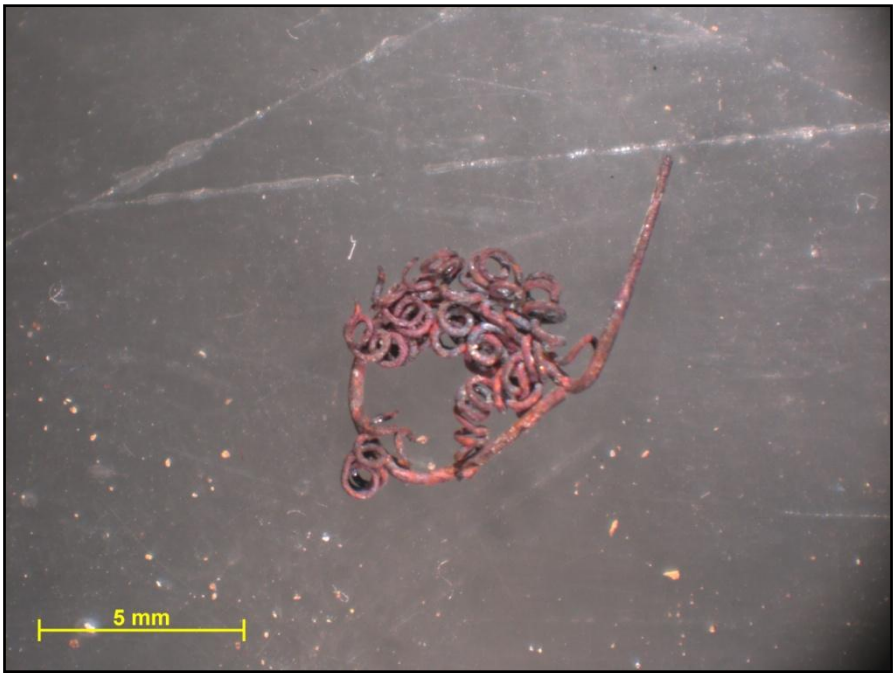

Figure 4.20: metal element #2 found in the skeletal area of the skull for the individual with find number 5917.

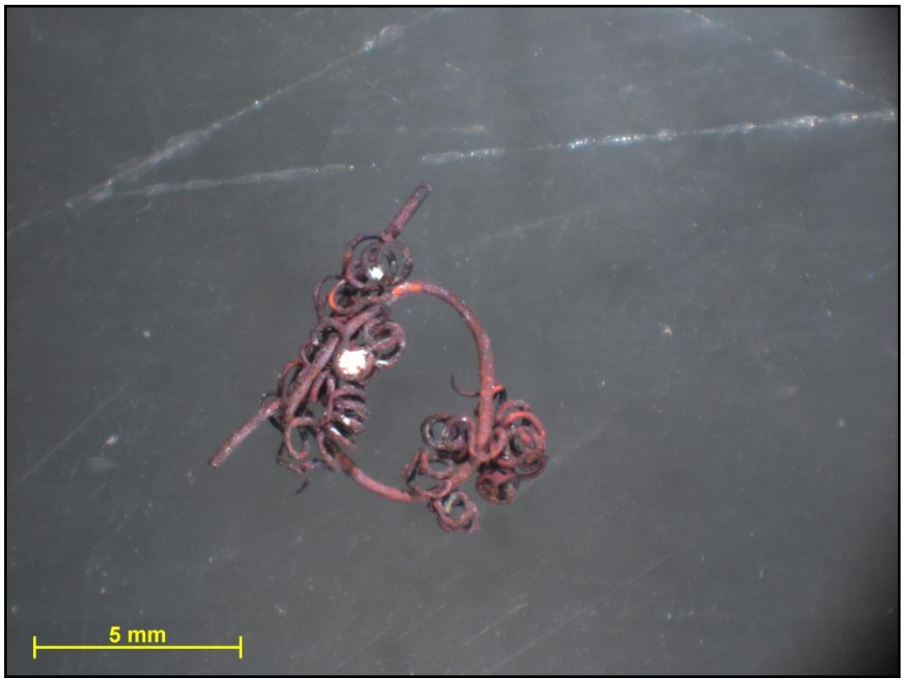

Figure 4.21: metal element #3 found in the skeletal area of the skull for the individual with find number 5917.

Other metal objects were documented for individual with find number 3797. These are 9 very small metal objects. The majority of these objects appear to be small nails. For other individuals larger nails have been found during analysis, but these were not documented as these nails were probably coffin nails.

Copper material (MCU) was documented for the skeletal area of the skull; this was for the individuals with find number 3087, 3797, and 5830. For the individual with find number 3087 this consisted of copper material (and correlating green discoloration) on the right sphenoid. The copper material is not determinable to an object due to fragmentation and preservation. This was similar for the copper material documented for individual 3797. This consisted of small, indeterminable fragments which were found in the soil residue. The individual with find number 5830 was documented twice with copper material; this was also only present in the soil residue. One fragment was again not determinable to an object due to fragmentation and preservation (fig. 4.22). The other documented find was a small, copper ring with organic residue inside (fig. 4.23 and 4.24). Both objects were further analysed by microscopic analysis to better determine the shape of both documented fragments. The first object, the indeterminable copper fragment, also appeared to have some organic residue present, which will be discussed later. The copper ring was also analysed by microscopic analysis and was also placed in a microCT scan to determine both the shape of the object as well as to gain insight into the residue that was present inside the ring (fig. 4.25a, b). Based on the images of the microCT scan, it appears that the object is indeed a ring, but consists of a single wrapped wire.

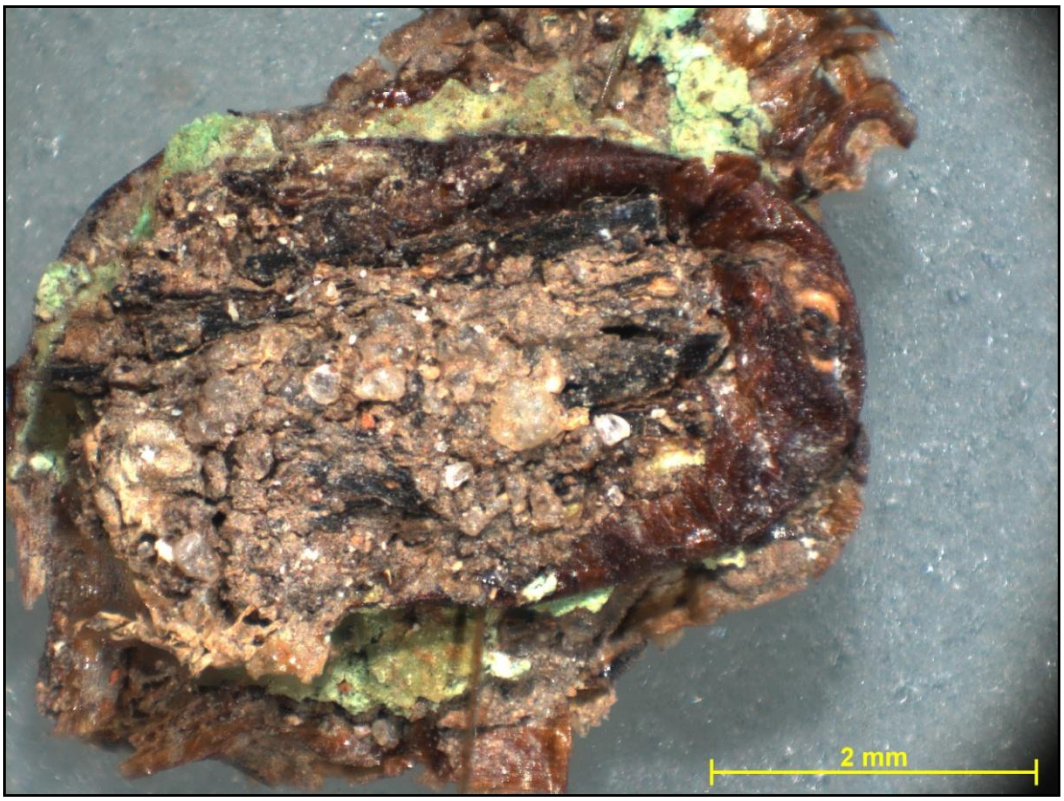

Figure 4.22: find #1 of copper residue in combination with organic residue (individual 5830).



Figure 4.23: find #2 copper ring containing organic residue (individual 5830).



Figure 4.24: find #2 copper ring containing organic residue (individual 5830).

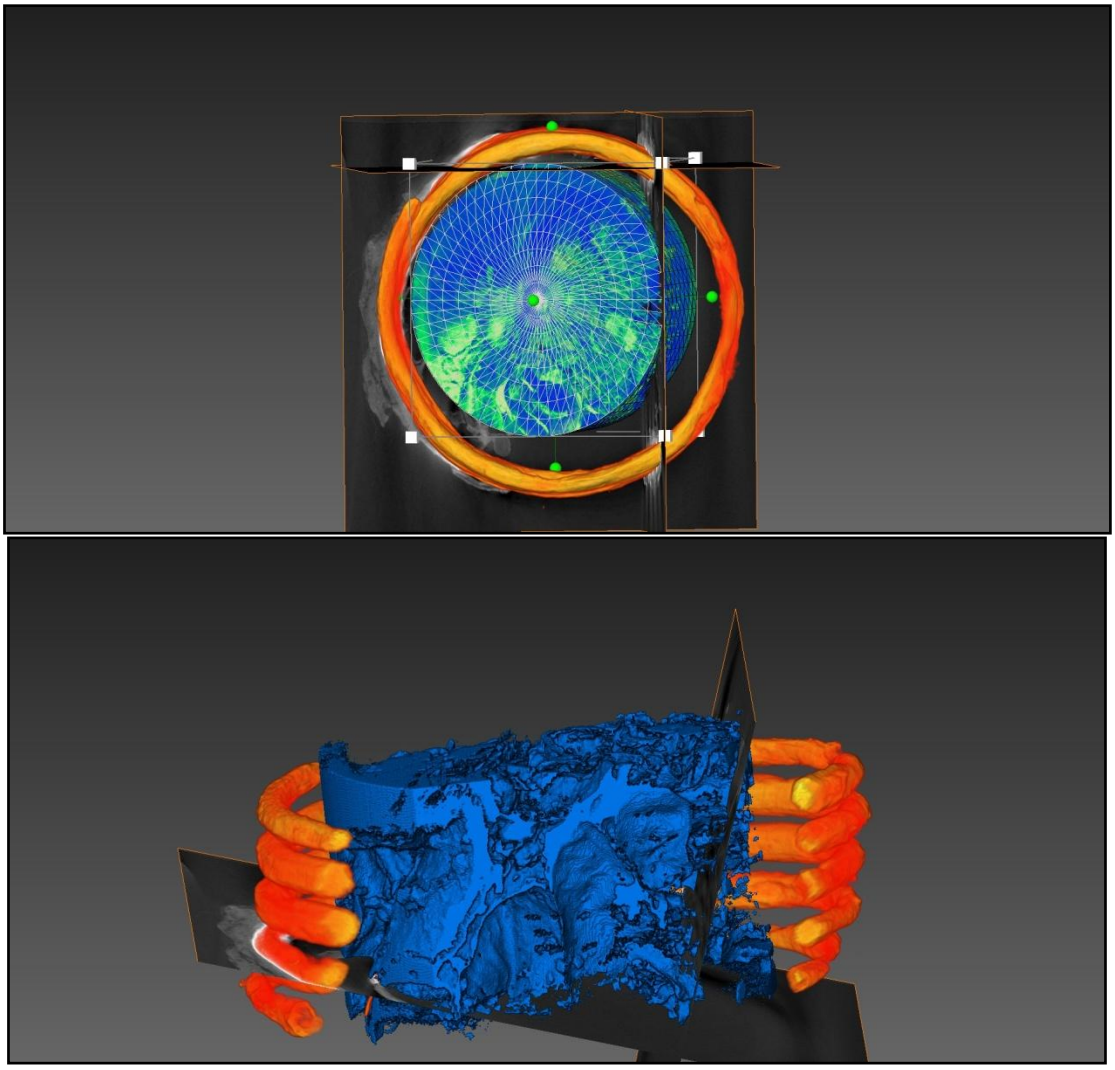

Figure 4.25a, b: find #2 from individual with find number 5830. Up (a): microCT scan of the copper ring from figure 4.18-4.19, view is from above. Down (b): microCT scan of the same copper ring; view is from the side. Note the layering of a wire to form a ring. In both images, blue is organic material and orange is copper.

Besides copper, a few fragments of iron, or iron residue to be more exact, were documented on two individuals (find numbers 1694 and 1875). The iron residue on individual 1694 was present on the frontal, between the two orbits (forehead) as can be seen in figure 4.26. For individual with find number 1875 this was located on the left parietal-temporal transition (fig. 4.27), as well as on the right parietal-temporal transition (fig. 4.28). As can be observed in both figure 4.27 and 4.28, these iron residues are in combination with green discolorations; for figure 4.27 this is not visible, but green discoloration was present on the parietal-temporal transition, located more anteriorly.



Figure 4.26: iron residue between the orbits, on the forehead (individual 1694).Note the nearby green discoloration of the skull.

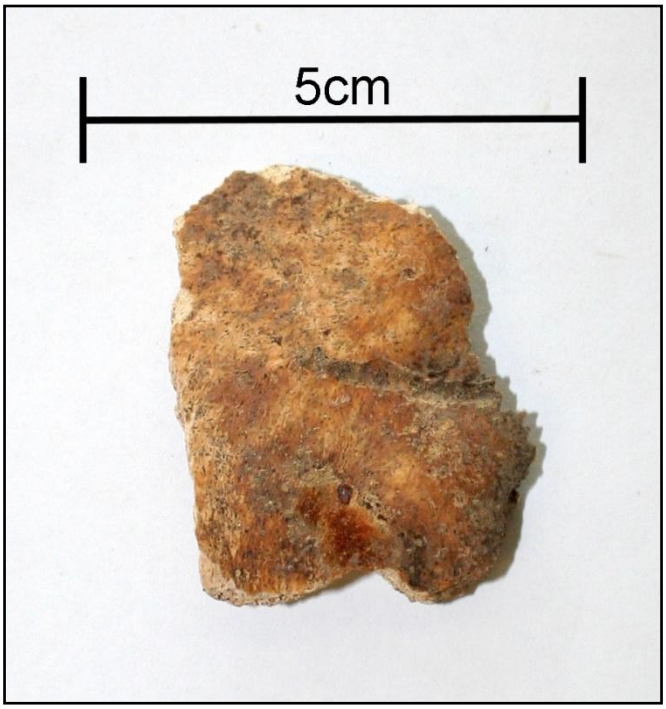

Figure 4.27: iron residue located on the left parietal-temporal transition (individual 1875). Displayed is only the parietal; the iron residue is located inferiorly.

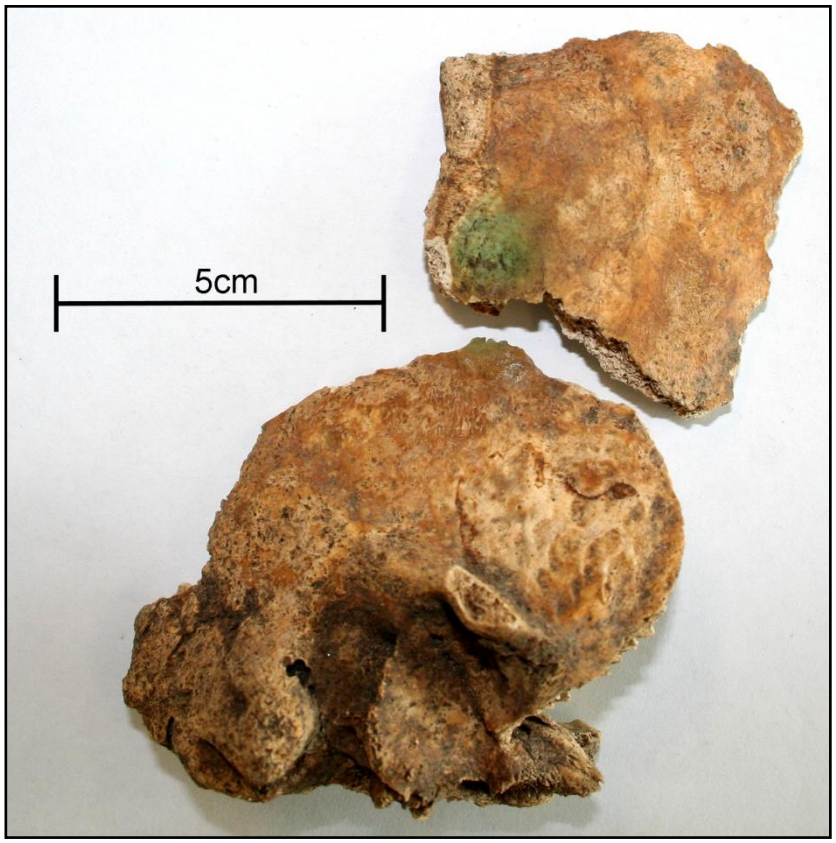

Figure 4.28: iron residue located on the right temporal (individual 1875) It is located anteriorly of the temporal, and shape like half a circle. Note the nearby green discoloration on the parietal.

Glass fragments (GLS) in the area of the skull were documented for 6 individuals. These are the individuals with find number 5830, 3087, 3797, 1707, 1695, and 3290. With the exception of individuals with find number 1695, 3290 and 3797, these glass fragments are relatively small and thin (<1mm). The small size of these fragments results in a limitation in observation; often these fragments were only observed by the reflection of light as they are not completely visible to the naked eye. The fragments appear to be either blue or red glass, or a variation thereof (light blue and light red/pink). Individual with find number 5830 was documented with the most fragments of glass, and some of these fragments were still in situ on the skull. The glass fragments were present on the right parietal-occipital (see fig. 4.18) and are illustrated in figure 4.29, 4.30, 4.31, and 4.32.

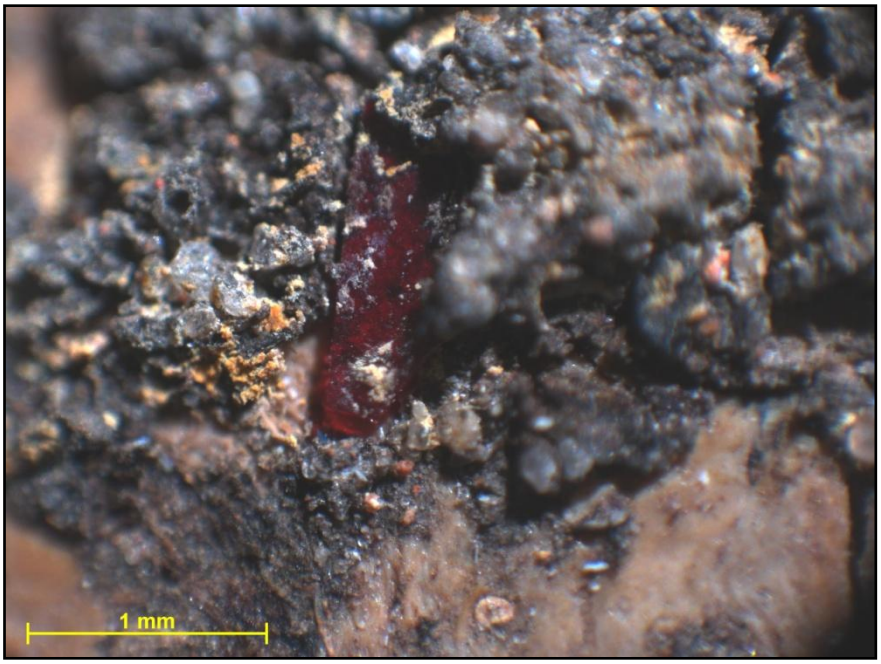

Figure 4.29: red glass fragment on right parietal-occipital (individual 5830).

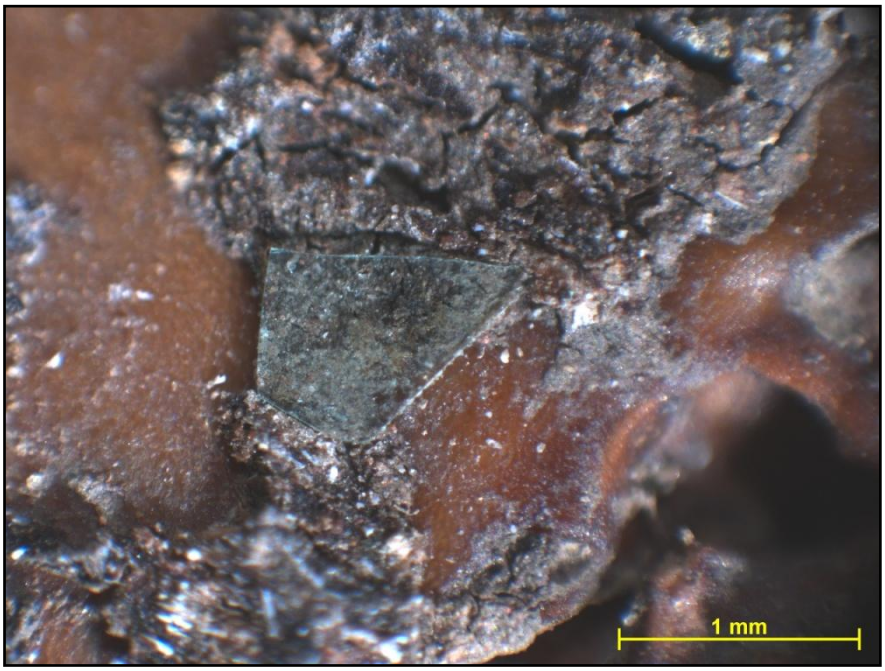

Figure 4.30: light-blue glass fragment on right parietal-occipital (individual 5830).

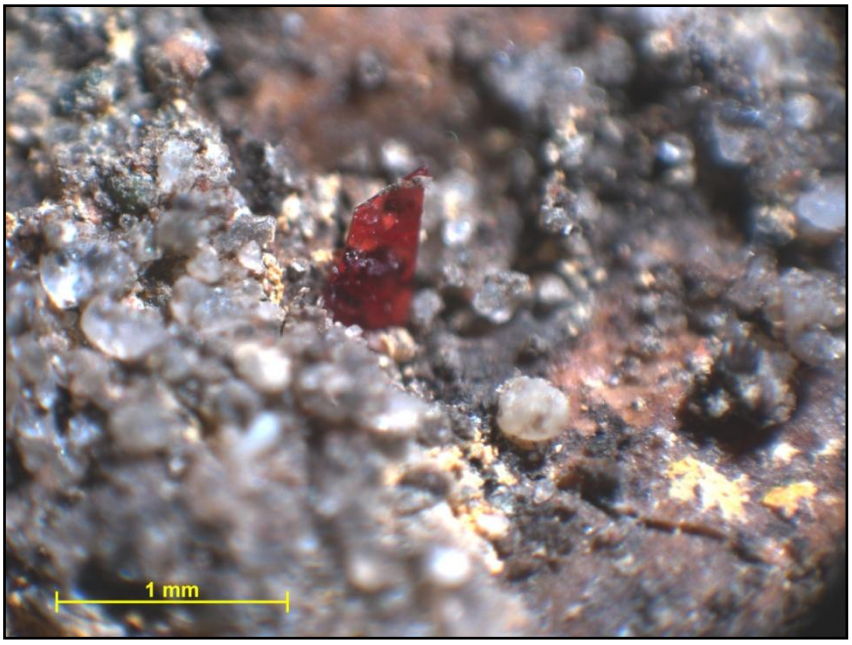

Figure 4.31: red glass fragment on right parietal-occipital (individual 5830).

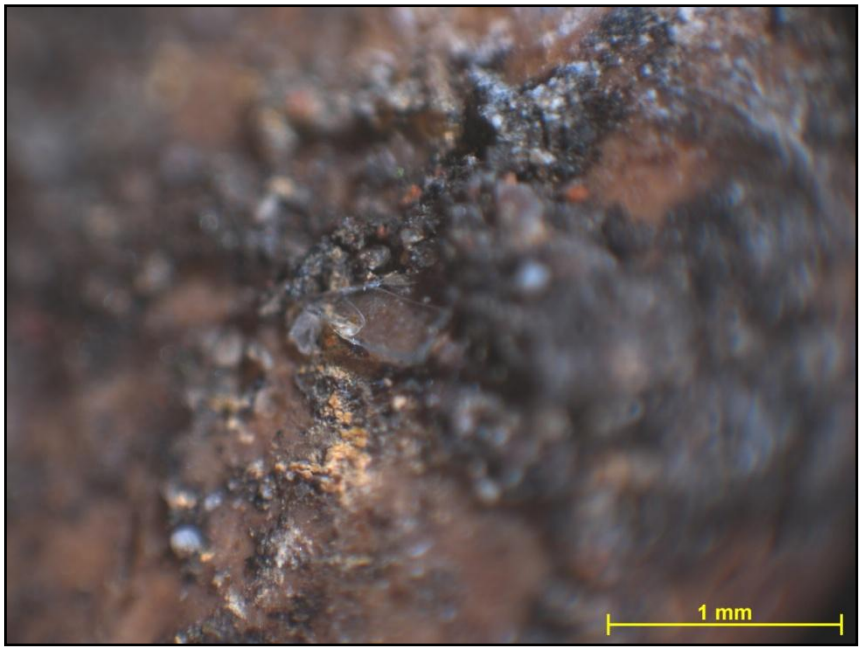

Figure 4.32: white/transparent glass fragment on right parietal-occipital (individual 5830).

Other glass fragments were documented for individual with find number 3087. These fragments were still in situ on the left maxilla (fig. 4.33, 4.34, 4.35, and 4.36).

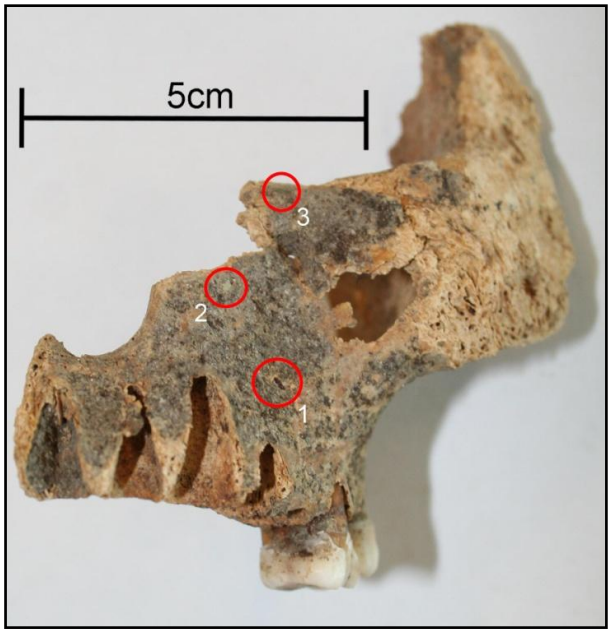

Figure 4.33: left maxilla with three glass fragments in situ (individual 3087). Numbers in this figure correspond with the numbers in the figures below.

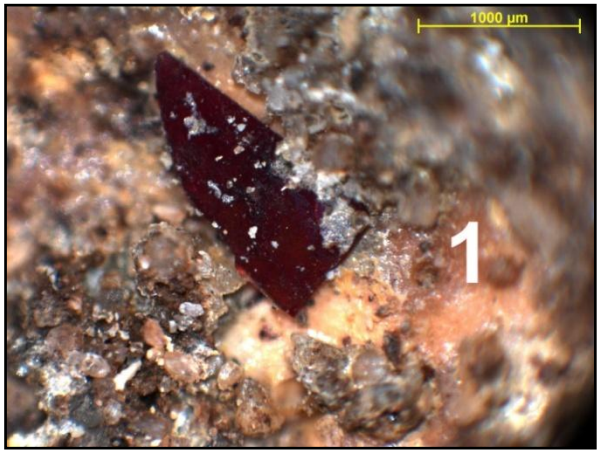

Figure 4.34: red glass fragment on left maxilla (individual 3087).

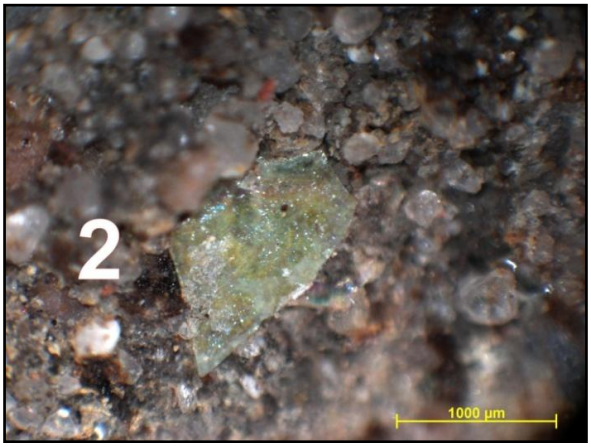

Figure 4.35: green-blue glass fragment on left maxilla (individual 3087).



Figure 4.36: green glass fragment on left maxilla (individual 3087).

Other fragments of glass found in the body region of the skull were documented for individuals with find number 1695, 3290, and 3797. For all of these individuals, the documented fragments of glass are larger than previously mentioned fragments of glass. In addition, they are slightly thicker and all are white/transparent. The glass fragments documented for individuals with find number 1695 and 3290 were not photographed; they are, however, similar in shape and appearance as the glass fragments documented for individual with find number 3797 (fig. 4.37).

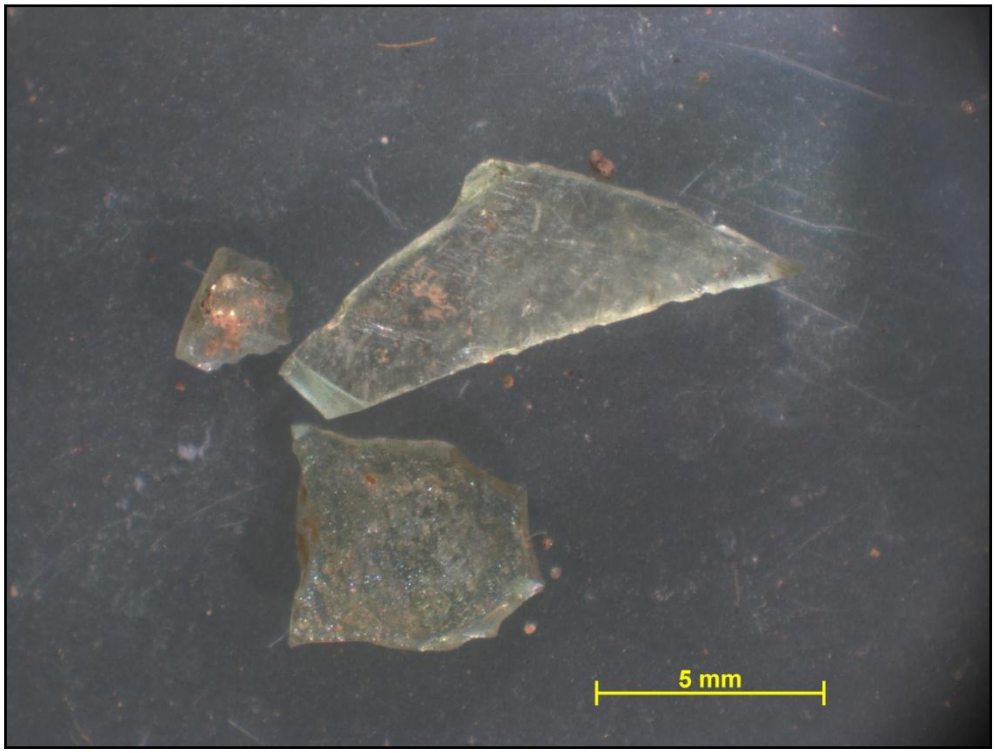

Figure 4.37: glass fragments (individual 3797).

Pottery finds (AW) are scarce in this study, and were due to this not further analysed. In the body region of the skull only one individual was documented with a pottery fragment, this is for individual with find number 3797.

The last category of finds, organic residue (OXX), found in combination with green discolorations. As already described by the copper materials which were documented, most of the organic residue was documented for individual with find number 5830. Both the indeterminable copper fragment and the ring contained organic residue (fig. 4.22, 4.23, and 4.24). In addition, for the body region of the skull another small fragment of organic residue was also found for individual with find number 5830. This fragment (fig. 4.38) was also further analysed by microscopic analysis. This analysis indicated that the organic material is probably hair, in combination with organic residue which was identified as plant (probably grass or a similar plant). The indeterminable copper fragment, as previously described, also contains this same plant type, as there are quite some similarities in morphology for both fragments. However, for this indeterminable copper fragment, the plant-residue forms an oval-shaped object that lies on top of the copper residue (fig. 4.22). Some plant-residue also appears to be present in and around the copper residue.

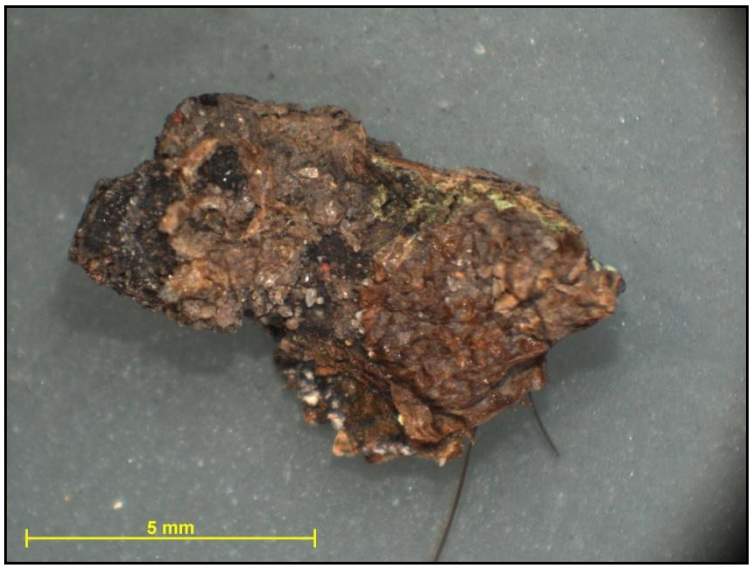

Figure 4.38: organic residue found in the skeletal area of the skull for the individual with find number 5830.

The individual with find number 4453 was also documented with organic residue. This residue is located on the right temporal, and is present as a straight line from the anterior towards the posterior side (fig. 4.39). This organic residue is also probably hair, though it is not certain if this was from the individual or belonging to some type of decoration.

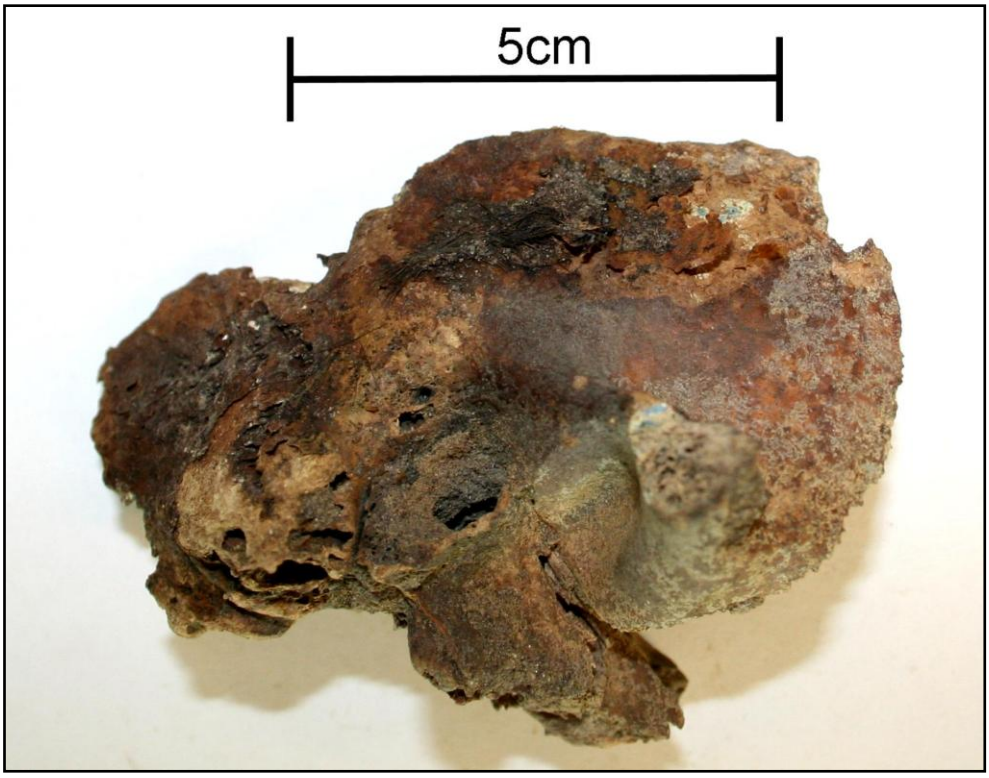

Figure 4.39: organic residue located on the right temporal (superiorly) of the individual with find number 4453.

Another individual documented with organic residue was the individual with find number 3797. Based on similarities in morphology between the organic residue of this individual, 4453, and 5830 this organic residue may also be hair (fig. 4.40).



Figure 4.40: organic residue, probably hair, found in the skeletal area of the skull for the individual with find number 3797.

4.2.2. Torso and shoulder girdle

The body region of the torso and shoulder girdle include several skeletal elements. The region of the torso contains all of the ribs and the sternum (thorax), but also the spine. The region of the shoulder girdle contains the scapulae and the clavicles. In the database, the torso and shoulder girdle are documented separately, as explained in chapter 3. Table 4.15 presents all these skeletal elements and the total number of individuals for which these skeletal elements could be inspected for (green) discoloration(s).

Table 4.15: overview of the torso and shoulder regions and the total number of individuals which could be inspected.

Torso and shoulder region	Number of individuals inspected
Scapula L	27
Scapula R	30
Clavicle L	26
Clavicle R	29
Ribs L	24
Ribs R	27
Sternum	8
Manubrium	9
Cervical vertebrae	33
Thoracic vertebrae	29
Lumbar vertebrae	26

Discolorations in the shoulder girdle were documented in 4 individuals, and a total of 6 times. Discolorations in the torso were documented more frequently; for 7 individuals discoloration(s) were documented for the spine, and a total of 13 times. Also, discoloration(s) for the category of the thorax were documented for 9 individuals, and a total of 15 times.

4.2.2.1 Discolorations on bone

The green discolorations on the shoulder girdle were documented for three individuals. These are the individuals with find number 1694, 4883, and 4889. For the individual with find number 1694, the green discoloration was observed on the right scapula and the right clavicle; a correlating location when the two skeletal elements are in articulation (fig. 4.41a, b). The other two individuals have no correlating green discoloration; it was present only on the right scapula for individual with find number 4889 and for the individual with find number 4883 green discoloration was observed on the right scapula and left clavicle.



Figure 4.41a, b: left (a): Right scapula with green discoloration (individual 1694). Right (b): right clavicle with green discoloration (individual 1694).

Green discoloration on the ribs and/or sternum was documented for 9 individuals. The green discoloration was often observed on the left ribs (n=4), and less frequent on the right ribs (n=2). It occurs both on the shaft of a rib as well as a sternal end. Only the individual with find number 1695 was documented with green discoloration on both first ribs. Individual with find number 1694 was documented with green discoloration only on the left first rib (fig. 4.42). Due to fragmentation of the ribs, it was not in all cases (n=4) possible to determine the exact rib or to side the rib. Green discoloration was also observed on the sternum/manubrium for three individuals (find numbers 1887, 3087, and 1875).



Figure 4.42: left first rib (individual 1694) with green discoloration on the shaft, near sternal end.

For the spine, most green discolorations were documented on the vertebral bodies, especially on the anterior surface (n=8). Only for the individual with find number 1707 the green discoloration was documented for the neural arch of the vertebrae. The vertebrae documented most frequently with green discolorations are the lumbar vertebrae (n=5), though high thoracic (n=2) and low cervical (n=1) also occur. Individual with find number 2403 was documented with green discoloration on the C7, T1, L2 and the L5. Green discoloration on the lumbar vertebrae was also documented for individual with find number 3087 (the L3 and L4). Furthermore, individual with find number 899 was documented with green discoloration on the L5.

Blue discoloration was only documented once; this was on the right scapula for individual with find number 4453. All of the discolorations of the thorax, spine, and shoulder girdle are presented in table 4.16, sorted by find number.

Table 4.16: overview of the individuals with discolorations on the torso and shoulder girdle.

Find number	Type residue	Category	Skeletal element	Location
899	green	spine	L5	body anterior
1694	green	shoulder girdle	clavicle R	posterior-lateral
1694	green	shoulder girdle	scapula R	lateral
1694	green	thorax	rib 1 L	shaft superior
1695	green	thorax	rib 1 L	shaft
1695	green	thorax	rib 1 R	shaft
1707	green	spine	neural arch	indet
1707	green	spine	neural arch	indet
1875	green	thorax	ribs indet, 2x	sternal end
1875	green	thorax	manubrium	superior
1887	green	thorax	manubrium	anterior
2243	green	spine	vertebral body	indet
2403	green	spine	L5	body anterior
2403	green	spine	L2	body anterior
2403	green	spine	T1	body anterior
2403	green	spine	C7	body anterior
3087	green	spine	L4	body anterior
3087	green	spine	L3	body anterior
3087	green	thorax	sternum	lateral
4453	blue	shoulder girdle	scapula R	lateral
4883	green	shoulder girdle	clavicle L	anterior-lateral
4883	green	shoulder girdle	scapula R	lateral
4883	green	thorax	ribs R	sternal end
4889	green	shoulder girdle	scapula R	lateral
4889	green	thorax	ribs indet	shaft
5830	green	thorax	ribs L, 2x	shaft
62052	green	spine	Thoracic, 2x, ribs shaft	indet

4.2.2.2 Finds

For the shoulder girdle no finds were documented, and for the torso region three finds were documented. This included a metal fragment (fig. 4.43) that was found on a thoracic vertebra of individual with find number 5830. The metal fragment has not been further determined. The other documented find was a fragment of glass for individual with find number 4889. This fragment of glass was, however, thicker and larger than previously mentioned glass fragments, and may be from an utensil made of glass. Moreover, a fragment of glass was also documented for individual with find number 5830. This is a smaller and thinner glass fragment than the fragment for individual with find number 4889, and is similar to previously mentioned glass fragments; especially glass fragments for this individual documented for other skeletal areas (e.g. skull).



Figure 4.43: metal fragment found on the thoracic vertebrae (individual 5830); located right inferior-lateral.

4.2.3 Upper limbs

The upper limbs consist of the humeri, radii, and ulnae. Table 4.17 presents all these skeletal elements and the total number of individuals for which these skeletal elements could be inspected for (green) discoloration(s).

Table 4.17: overview of the upper limbs and the total number of individuals which could be inspected.

Upper limbs	Number of individuals inspected
Humerus L	32
Humerus R	39
Radius L	22
Radius R	30
Ulna L	26
Ulna R	31

In total, skeletal elements of the upper limbs were, divided over 10 individuals, documented 15 times.

4.2.3.1 Discolorations on bone

Both green and blue discolorations were documented, though the blue discoloration was documented only once. This was for the individual with find number 4139, and it was located on the right humerus. However, the right humerus was the only skeletal element present for this individual in this specific body region. The blue discoloration was diffuse.

The green discoloration was documented 9 times on various locations, divided over 7 individuals. The ulnae and radii (n=4 and n=3 respectively) are more frequently documented than the humeri (n=2), and left skeletal elements (n=5) occur almost as often as right ones (n=4). In most cases, for only one skeletal element green discoloration was documented. For example, individual with find number 899 was documented with green discoloration only on the left ulna (fig. 4.44a); and green discoloration on only the right radius was documented for individual with find number 1831 (fig. 4.44b). Articulating locations and skeletal elements were also observed with green discoloration; individual with find number 6205.1 was documented with green discoloration on both the left radius and ulna, on their articulating proximal surface (fig. 4.45). Individual with find number 5830 had, however, green discoloration on the right radius and left ulna, but not their articulating skeletal counterparts (fig. 4.46a, b). This individual was also documented with green discoloration on the distal end of the left humerus; this was in combination with organic residue (see next paragraph). The documented discolorations are presented in table 4.18, sorted by find number.



Figure 4.44a, b: left (a): left ulna with green discoloration on the shaft (individual 899). Right (b): right radius with green discoloration on the distal end (individual 1831).



Figure 4.45: left radius and ulna (6205.1) with green discoloration on their articular surface.



Figure 4.46a, b: left (a): left ulna with green discoloration (individual 5830). Right (b): right radius with green discoloration (and organic residue, see finds) (individual 5830).

Table 4.18: overview of the individuals with discolorations on the upper limbs.

Find number	Type residue	Category	Skeletal element	location
899	green	upper limbs	ulna L	distal-medial
1695	green	upper limbs	ulna R	proximal-medial
1831	green	upper limbs	radius R	distal-posterior
3290	green	upper limbs	humerus L	proximal
4139	blue	upper limbs	humerus R	shaft
4889	green	upper limbs	humerus R	humeral head
5830	green	upper limbs	humerus L	distal-anterior
5830	green	upper limbs	ulna L	proximal
5830	green	upper limbs	radius R	proximal
6205.1	green	upper limbs	ulna L	proximal-lateral
6205.1	green	upper limbs	radius L	proximal-medial

4.2.3.2 Finds

Though the finds documented for this body region are not diverse in category (table 4.19), they are remarkable for the represented categories. For the metal/iron category only three locations were observed. These were on the right humerus of the individual with find number 2366 (fig. 4.47a, b). The finds consist of metal/iron residue, which is concentrated on the anterior shaft twice and once on the distal-posterior surface of the humerus. The only other category represented in this body region is organic residue, and was documented for individual with find number 5830. Similar to the organic finds around the skull of this individual, both the distal left humerus and the proximal head of the right radius were documented with organic material; both in combination with green discoloration. Again, this organic material appears to be from a plant (again, probably grass or a similar plant). It is still *in situ* on the distal humerus (fig. 4.48 and 4.49a), and for the proximal head of the radius some organic residue was also still intact (fig. 4.49b). In addition, some fragments of copper residue as well as small fragments of organic residue were documented for the individual with find number 5830 for this skeletal area (fig. 4.50). Table 4.16 presents the aforementioned finds and their location(s).

Table 4.19: overview of the finds on the upper limbs.

Find number	Type residue	Category	Skeletal element	location
2366	mxx	upper limbs	humerus R	distal-posterior
2366	mxx	upper limbs	humerus R	shaft
5830	oxx	upper limbs	humerus L	distal-anterior
5830	oxx	upper limbs	radius L	proximal



Figure 4.47a, b: left (a): anterior view of humerus, with iron reside (individual 2366). Right (b): posterior view of humerus, with iron residue (individual 2366).

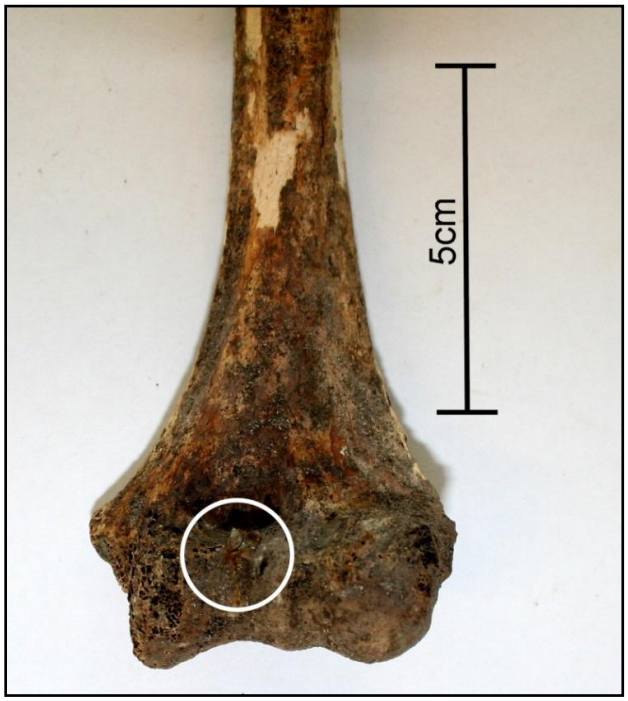

Figure 4.48: anterior view of the left humerus, on the distal end (encircled) organic residue was documented (individual 5830). See figure 4.49a for a detailed view.

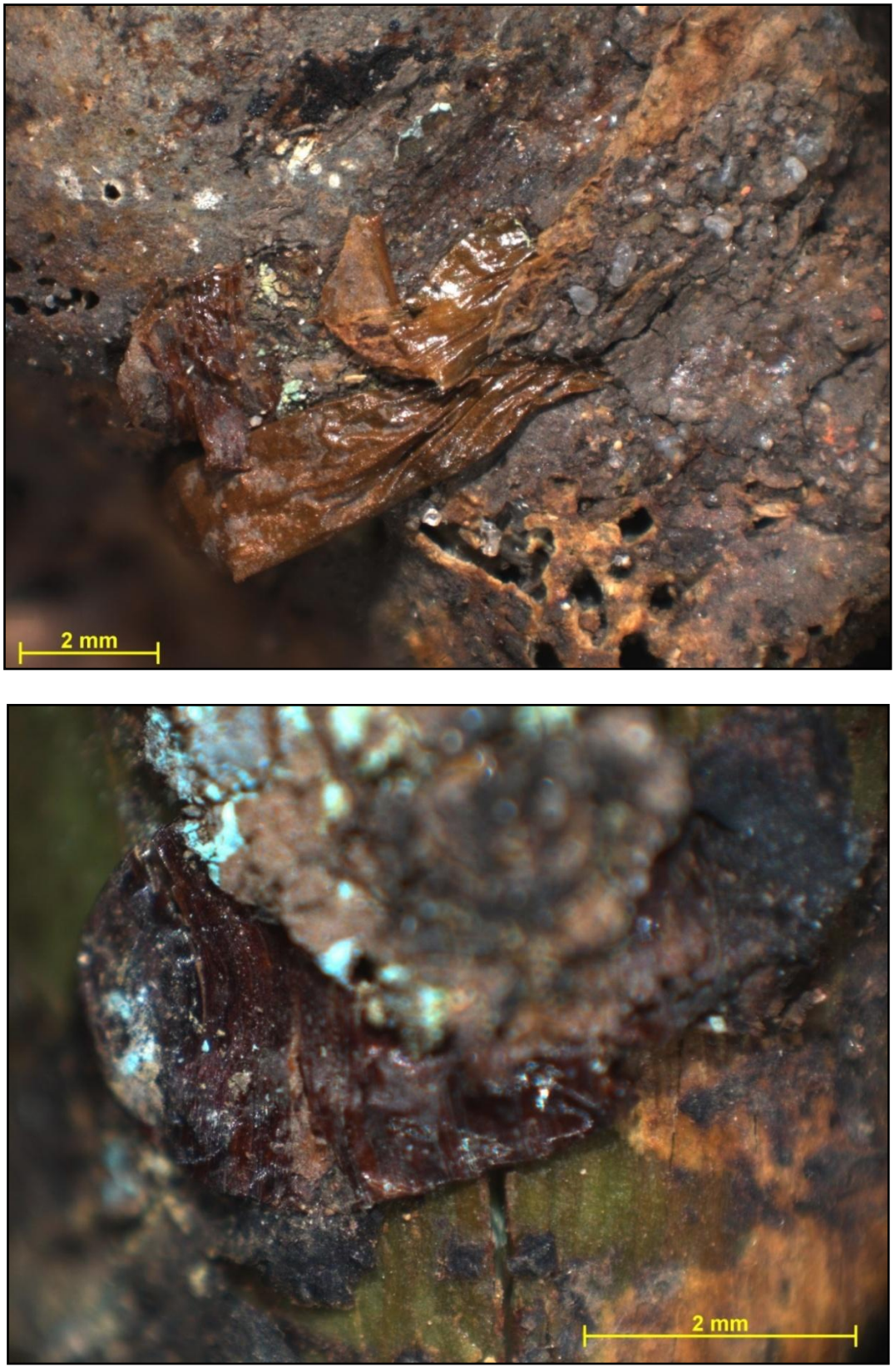

Figure 4.49a, b: up (a): left distal humerus (individual 5830) with organic residue (same as in fig. 4.48). Note the dark-red as well as the brown colored organic residue. Down (b): right proximal radius (individual 5830) with organic residue. Note only the dark-red organic residue.



Figure 4.50: organic residue found by the right radius (individual 5830). Note the copper residue (left) and the brown colored organic residue (down).

4.2.4 Hands

The results for the body region of the hands are presented separately, as explained in chapter 3. Table 4.20 presents all these skeletal elements and the total number of individuals for which these skeletal elements could be inspected for (green) discoloration(s).

Table 4.20: overview of the hand region and the total number of individuals which could be inspected.

Hand region	Number of individuals inspected
Carpals L	5
Carpals R	4
Metacarpals L	16
Metacarpals R	16
Phalanges (prox.)	10

Divided over three individuals, the database holds only 7 records for this body region.

4.2.4.1 Discolorations on bone

For the body region of the hands only green discoloration was documented. This is present in three individuals; find number 1694, 1831, and 5830. The individual with find number 1694 was documented with green discoloration on the metacarpals and right carpal (lunate). The left first metacarpal and the right second, fourth, and fifth metacarpals were documented with green discoloration (fig. 4.51). This was present on either the dorsal or plantar surface; but located on the shaft and distal ends. For the individual with find number 5830, the green discoloration was only present on of the left carpals (scaphoid). Green discoloration was present on the (probably right) 4th proximal phalange (distally) for individual with find number 1831.



Figure 4.51: left first metacarpal (left) and right second, fourth, fifth metacarpal, and right lunate with green discoloration (individual 1694).

4.2.4.2 Finds

No finds were documented for the body region of the hands.

4.2.5 Pelvic girdle

The pelvic girdle consists of the ilium, ischium, and pubis (left and right for all skeletal elements). Table 4.21 presents all these skeletal elements and the total number of individuals for which these skeletal elements could be inspected for (green) discoloration(s).

Table 4.21: overview of the pelvic region and the total number of individuals which could be inspected.

Pelvic region	Number of individuals
Ilium L	27
Ilium R	32
Ischium L	24
Ischium R	23
Pubis L	5
Pubis R	7

In total, divided over 9 individuals, the database holds 13 records for the pelvic girdle.

4.2.5.1 Discolorations on bone

Only green discoloration was observed for this body region. The most frequently occurring skeletal element is the ilium (n=4), in particular the location of the iliac fossa (fig. 4.52a, b). Green discoloration was observed on both the posterior as well the anterior sides of the iliac fossa, though separately. Both the right ilium and left ilium were documented twice, but both occur only separately. The only skeletal element which was documented with green discoloration on both right and left sides was the auricular surface of individual with find number 3087. Due to poor preservation, the right side was not as clear as the left side. Individual with find number 4883 was documented with green discoloration on the right pubis, located on the posterior surface. Green discoloration in combination with organic residue (see next paragraph) was, again, documented in individual with find number 5830. This was located on the posterior surface of the iliac fossa, superior of the acetabulum (fig. 4.53). In addition, small fragments of the pelvis with green discoloration were also documented for this individual. For the individual with find number 6541, green discoloration was also documented for a bone fragment that may be from the pelvic girdle. The documented discolorations are presented in table 4.22, sorted by find number.



Figure 4.452a, b: left (a): left ilium with green discoloration on the iliac fossa (individual 1205). Right (b): right ilium with green discoloration on the iliac fossa (individual 2009).

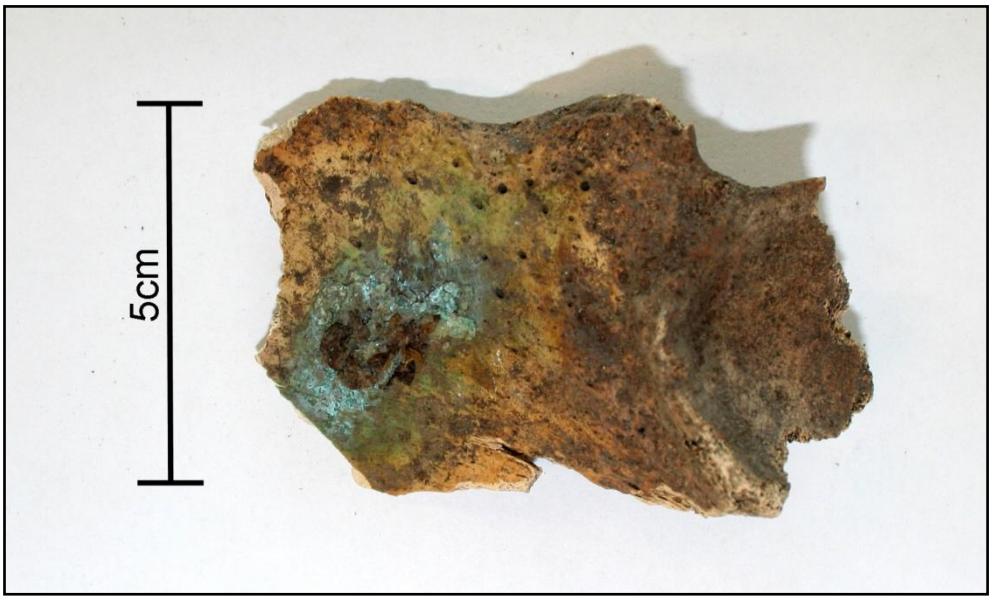

Figure 4.53: right ilium, posterior aspect with green discoloration and organic residue (left is proximal; right is distal) (5830).

Table 4.22: overview of the individuals with green discoloration on the pelvic girdle.

Find number	Type residue	Category	Skeletal element	Location
1205	green	pelvic girdle	ilium L	iliac fossa anterior
1694	green	pelvic girdle	acetabulum R	distal
2009	green	pelvic girdle	ilium R	iliac fossa anterior
3087	green	pelvic girdle	auricular surface L	anterior
3087	green	pelvic girdle	auricular surface R	proximal
3515	green	pelvic girdle	ilium L	iliac fossa anterior
4883	green	pelvic girdle	pubis R	posterior
5830	green	pelvic girdle	unknown	unknown
5830	green	pelvic girdle	ilium R	iliac fossa posterior
6451	green	pelvic girdle	unknown	unknown

4.2.5.2 Finds

Finds documented for the body region of the pelvic girdle were observed for individuals with find number 3797 and 5830. For individual with find number 3797 a fragment of glass was documented. This fragment was, like the glass fragments documented for the skull area of this individual, relatively large and thick. For individual with find number 5830 both categories of GLS and OXX were documented. The organic residue was, as previously mentioned, observed with green discoloration on the posterior surface of the right ilium. It is surrounded by this green discoloration, and the organic residue is shaped ovally. This was also further analysed by microscopical analysis, of which the results indicate that it consists also of the same plant/grass which was observed by the organic residue on the humerus and on the skull of the same individual. The organic residue on the ilium consists, however, of two different types. As can be observed in figure 4.54, two colours of organic residue can be distinguished. Furthermore, it consists of multiple layers; the darker (dark-red) organic residue appears to be underneath the lighter organic residue. The darker organic residue was also examined further; figure 4.55 illustrates the specific layering. It appears that it consists of different grass strands, placed after each other, and folded to form an oval-shaped object. From what is observable on figure 4.54, it seems that two of these oval-shaped objects are present. Furthermore, some small, loose fragments of organic residue were documented for this individual (fig. 4.56), as well as some copper residue. These small organic fragments are similar in morphology as the fragment found on the ilium.

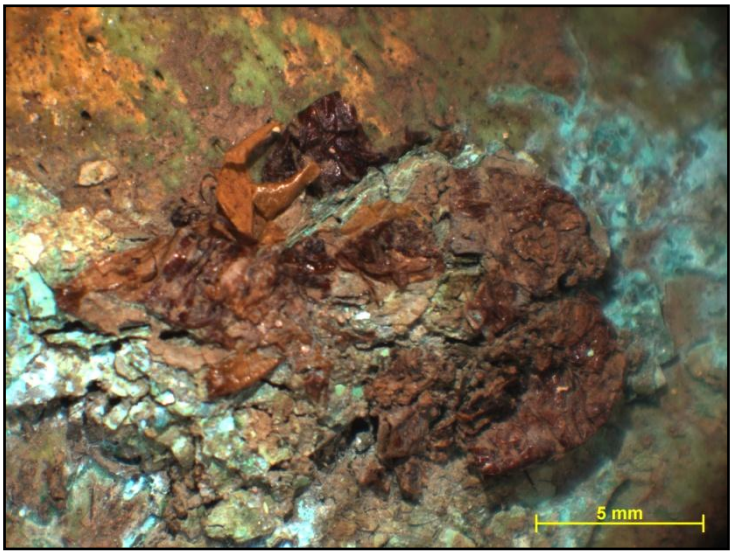

Figure 4.54: organic residue on the posterior aspect of the ilium (individual 5830).



Figure 4.55: close up of fig. 4.54; zoomed in on the dark-red organic residue (individual 5830).

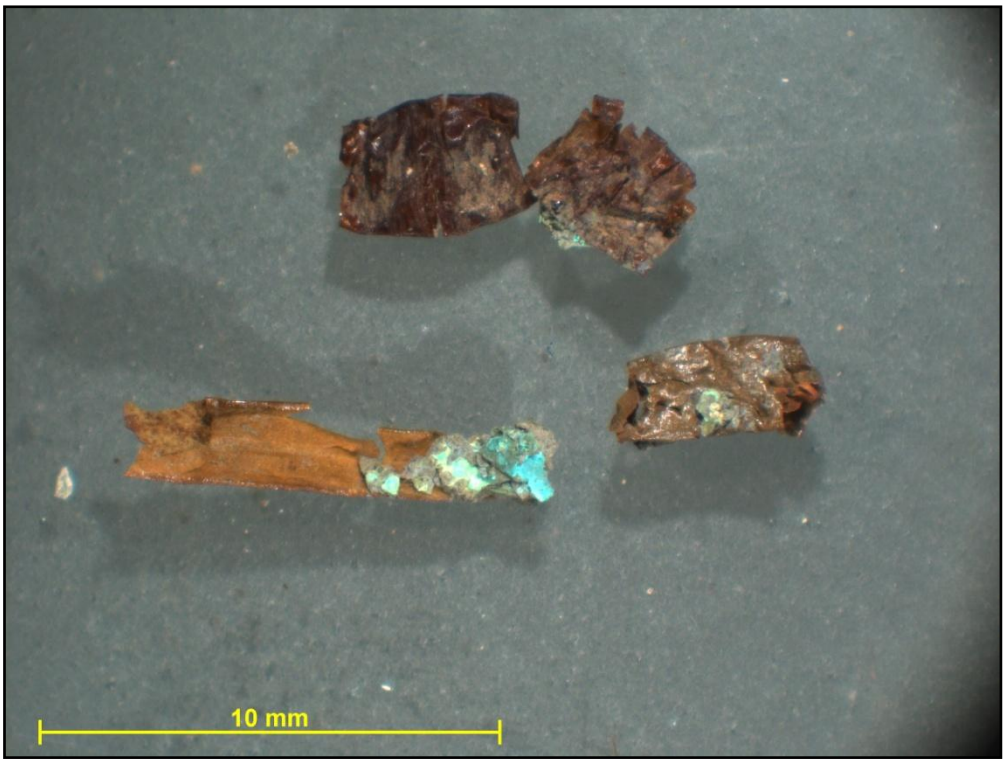

Figure 4.56: fragments of organic residue, found in the body region of the pelvis (individual 5830). Note the dark-red organic residue (up and right) and the brown coloured organic residue (down-left). Copper residue is also present.

On the left auricular surface of the individual with find number 5830, one fragment of glass was documented. This was again further analysed by microscopic analysis, of which the results can be seen in figure 4.57. Unfortunately, during further examination the glass fragment did not remain *in situ* (inset in fig. 4.57), but now the size of the fragment could be documented (approx. 1mm).

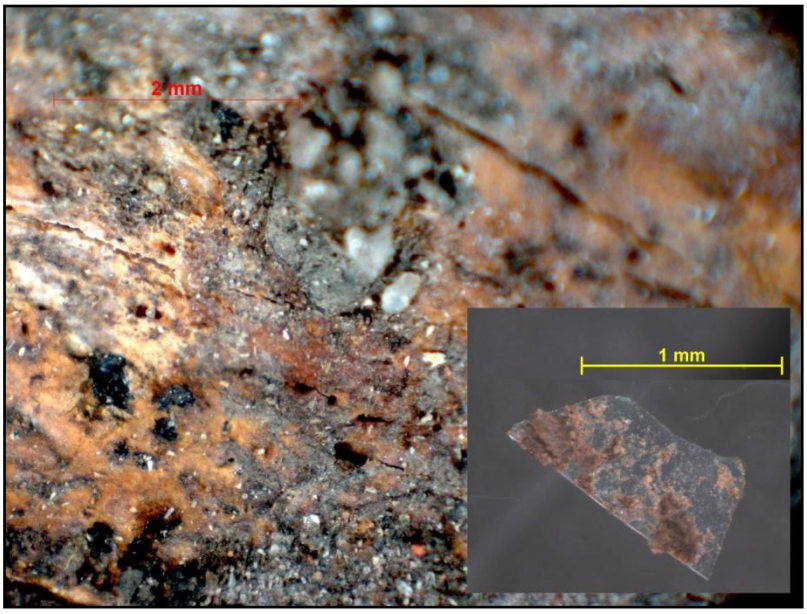

Figure 4.57: glass fragment on the left auricular surface (individual 5830).

4.2.6 Lower limbs

The lower limbs consist of the femora, tibii, and fibulae. Because the feet were not well represented in the selection under study (see table 4.23), these were included in the region of the lower limbs. Table 4.23 presents all these skeletal elements and the total number of individuals for which these skeletal elements could be inspected for (green) discoloration(s).

Table 4.23: overview of the lower limbs and feet and the total number of individuals which could be inspected.

Lower limbs	Number of individuals inspected
Femur L	30
Femur R	38
Tibia L	26
Tibia R	32
Fibula L	18
Fibula R	17
Tarsals L	6
Tarsals R	7
Metatarsals L	8
Metatarsals R	8

In total, divided over 7 individuals, the body region of the lower limbs and feet holds 14 records in the database.

4.2.6.1 Discolorations on bone

The green discoloration occurs more frequently and was documented most often for the right tibia (n=6). With the exception of individuals with find number 6205.1 and 6451 (see fig. 4.58a, b for the individual with find number 6205.1), no green discoloration on left skeletal elements or both left and right skeletal elements were documented. The green discoloration on the right tibia occurs most frequently on the shaft, though for the individual with find number 1694 it was documented on the proximal and distal ends, located posteriorly. Green discoloration on the right femur is also present; this occurs on the femoral head for the individuals with find numbers 1694 and 6205.1. The individual with find number 4883 was documented with green discoloration on the shaft of the right femur. In addition, only one individual was documented with green discoloration on one of the tarsals. This was the individual with find number 2366, and the green discoloration was located on the lateral surface of the right calcaneus. For one individual (find number 6451) green discoloration in combination with glass (see next paragraph) was documented. All of the documented discolorations are presented in table 4.24, sorted by find number.



Figure 4.58a, b: left (a): left and right tibia, lateral view (individual 6205.1). Right (b): left and right tibia, medial view (individual 6205.1).

Table 4.24: overview of the individuals with discolorations on the lower limbs.

Find number	Type residue	Category	Skeletal element	Location
1024	green	lower limbs	tibia R	medial
1694	green	lower limbs	tibia R	distal-posterior
1694	green	lower limbs	tibia R	proximal-posterior
1694	green	lower limbs	femur R	femoral head
2366	green	lower limbs	tarsals R	lateral
4883	green	lower limbs	femur R	shaft
5917	blue	lower limbs	femur R	shaft
6451	green	lower limbs	tibia R	shaft
6451	green	lower limbs	tibia L	shaft
62051	green	lower limbs	femur R	femoral head
62051	green	lower limbs	tibia L	shaft
62051	green	lower limbs	tibia R	shaft

4.2.6.2 Finds

Only for three individuals finds were documented for the body region of the lower limbs and feet. As previously mentioned, one documented find were fragments of glass which were present on the right tibial shaft of individual with find number 6451 (fig. 4.59). In total 4 small fragments were documented (fig. 4.60 (close up of fig. 4.59), 4.61, 4.62, and 4.63), but based on microscopical analysis smaller fragments may be present underneath; these could not be fully documented. There appears to be no specific clustering of these fragments of the shaft, as the fragments are located all over the tibial shaft. The largest fragment of glass is approximately 2.5mm; relatively large. The other fragments are approximately 1mm or smaller. All of the glass fragments are transparent and were, when observed under the microscope (unfortunately not visible in the figures), very reflective. The location of these glass fragments on the tibia was also in combination with green discoloration, as previously mentioned. For another individual, find number 1707, a fragment of glass was also documented for the lower limbs. This fragment of glass was, however, not *in situ* and was in appearance different than the glass fragments for the individual with find number 6451. The fragment of glass for the individual with find number 1707 was not photographed. Furthermore, for the individual with find number 6205.1 iron residue was documented on the left tibial shaft (fig. 4.58a, b).

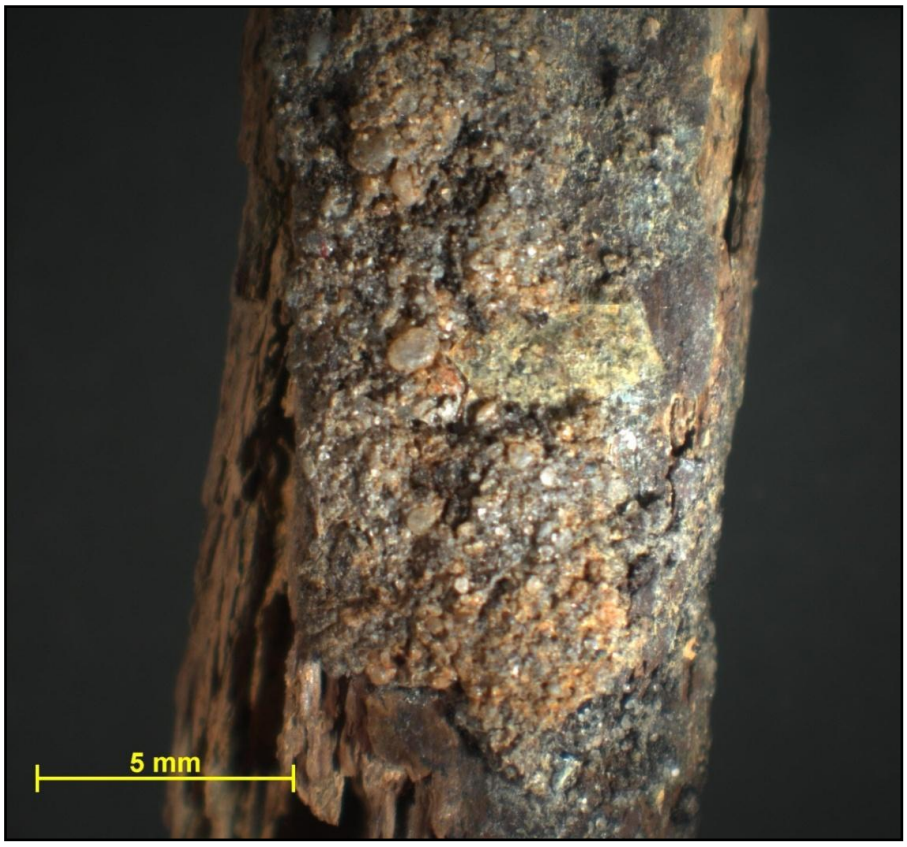

Figure 4.59: glass fragment on the right tibial shaft of the individual with find number 6451.

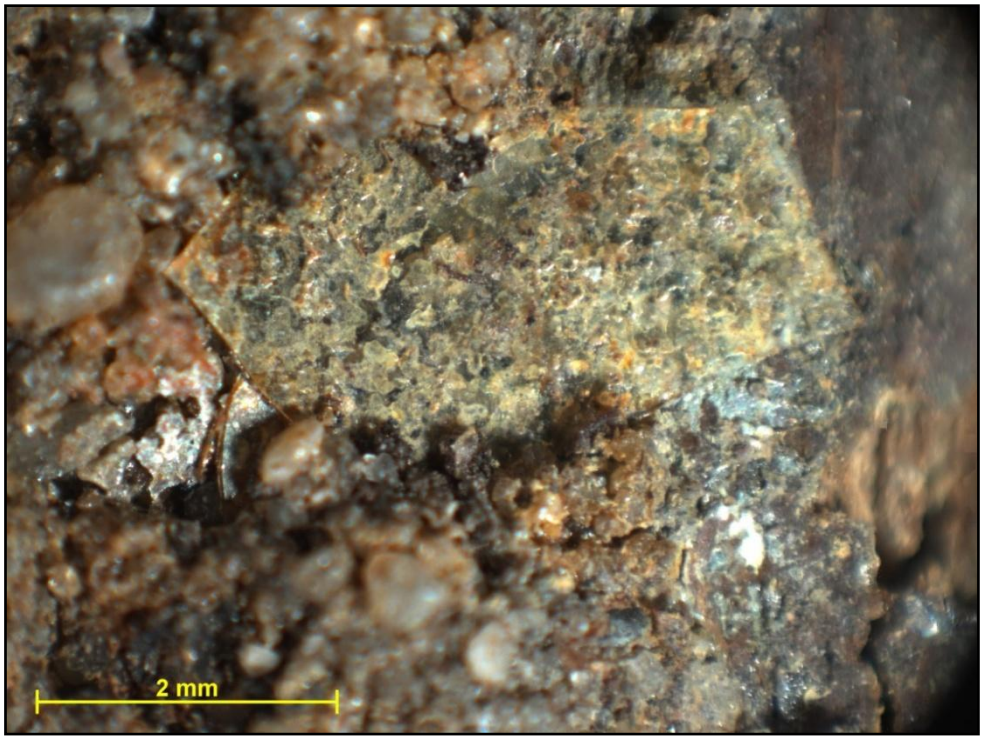

Figure 4.60: same glass fragment as in fig. 4.54; close up (individual 6451). Note the smaller glass fragments underneath this fragment, left-bottom of the large fragment.

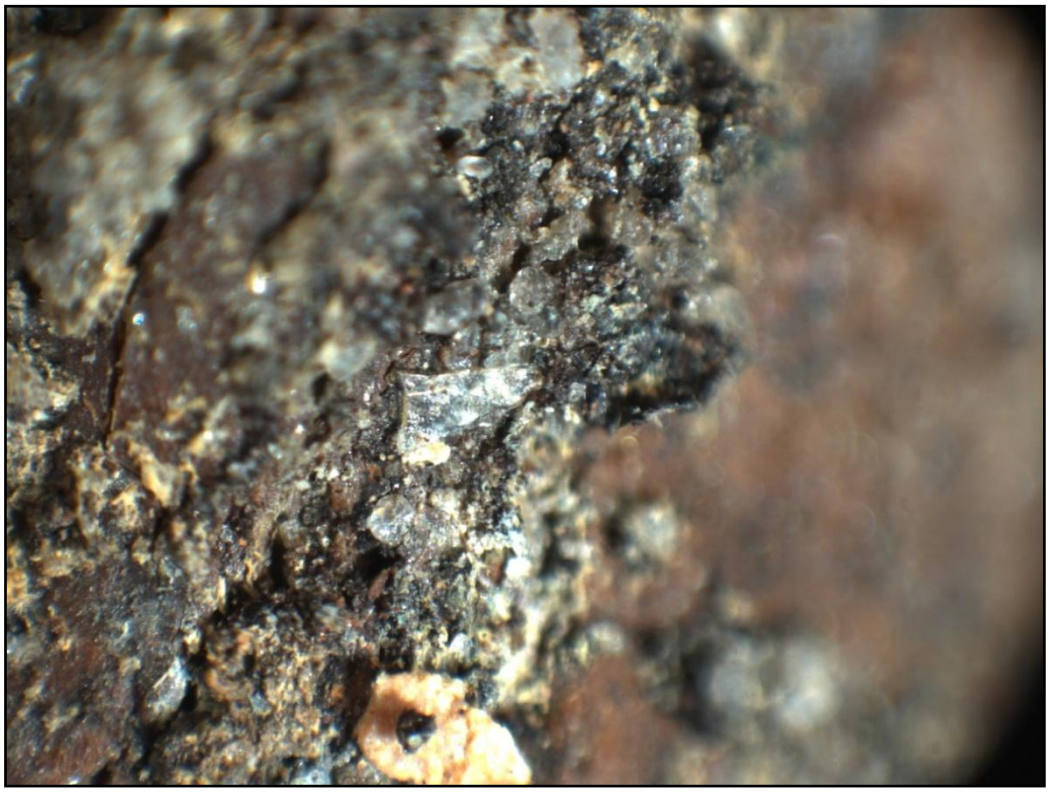

Figure 4.61: another glass fragment on the tibial shaft of the individual with find number 6451.



Figure 4.62: another glass fragment on the tibial shaft of the individual with find number 6451.

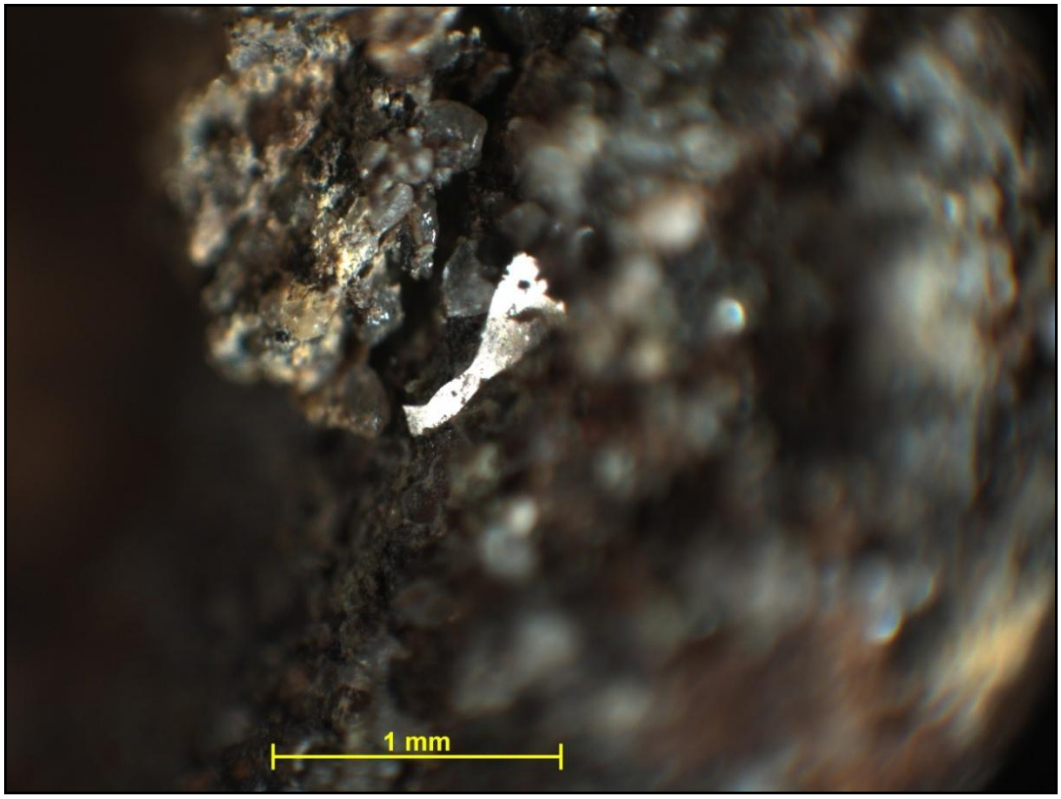

Figure 4.63: another glass fragment on the tibial shaft of the individual with find number 6451.

4.2.7 Finds without skeletal category

For two individuals, finds were documented without a skeletal category. This was because of preservation and the subsequent documentation; for most individuals each skeletal area (e.g. skull, spine) was placed in a separate zip-lock bag. However, a few individuals were poorly preserved or not all skeletal areas were represented for these individuals. This resulted in the fact that the complete skeleton was placed in one zip-lock bag; meaning specific finds could not be correlated anymore to a skeletal area, unless they were still *in situ*. Finds without a skeletal category were present for the individuals with find number 6451 and 6478.

For the individual with find number 6478, this was organic residue. Based on morphology of this organic residue, it was probably hair belonging to this individual. Because of this, it was not further analysed. Finds without a skeletal category for the individual with find number 6451 were fragments of glass. As other glass fragments were documented for the lower limbs (tibia) it is likely the fragments without skeletal category were also for the lower limbs. However, as glass fragments were in general frequently documented in the skull area, this may also be possible. The glass fragments are again very thin; the size of the fragments is, however, somewhat larger. Fragments of light-blue as well as light-red glass are present (fig. 4.64).



Figure 4.64: glass fragments documented without a skeletal category (individual with find number 6451).

4.2.8 Individuals with no finds and exceptions

Remarkably, for three individuals no finds on the bone or in the soil residue as well as discolorations on the bone were observed, though discolorations were noted during the excavation. Though errors in documentation may be possible, the absence of any finds or discolorations for two individuals may also be due to preservation; these individuals were poorly preserved. The individual with find number 6859 was represented by very poorly preserved long bone fragments and some dentition. The reason this individual was included in the selection was the presence of a crown number; fragments of which will be described in paragraph 4.2.9.

The individual with find number 3426 was better preserved than the other two individuals; however, no finds or discolorations were found on this individual. The individual was included in this selection because of the presence of green residue, as this was documented in the database used during the excavation. Furthermore, according to the database this individual was both well preserved and most skeletal areas were represented; meaning a full analysis could be done. The full analysis was indeed possible, but remarkably the green discoloration documented during the excavation did not correspond to any findings during the analysis.

The last individual, find number 6476, was also poorly preserved and only represented by fragments of the skull and three dental elements. However, this individual was also documented with a find number for the crown; find number 6470, indicating that finds are present. Even though no evidence of the funerary headdress could be observed in the skeletal material or in any finds in the soil residue during the physical anthropological analysis, the funerary headdress is present. The finds documented under find number 6470 were also analysed, though separately from the individuals (see paragraph 4.2.9).

4.2.9 Analysis of funerary headdresses and related finds

As has already been mentioned in paragraph 4.1.5, several individuals (n=15) were excavated with a funerary headdress present or at least with finds indicating a similar decoration; the crown individuals. During the excavation, these finds were given a separate find number; or crown number as referred to in this thesis. The content of each of these crown numbers varies between individuals; this was of course related to the composition of the original crown, general preservation and conservation, as well as how much was collected during the excavation. The material documented under these crown numbers was separated from the individual. Finds mentioned in the previous paragraphs were documented during the physical anthropological analysis and were analysed in this study; the material documented under the crown number was analysed by the ADC. In total, 158 fragments of wire/decorations were analysed (Nooijen, 2016, p.138). Findings and description of the material is presented in the excavation report (Nooijen, 2016, pp.138-142). These findings will be shortly presented below; this will be in combination with any finds belonging to the crown individuals documented during the physical anthropological analysis of this study.

Based on the material, different types of wire and constructions were noted (Nooijen, 2016, p.138-139). Each decoration was made from copper wire, also entwined with more copper wire (a more flattened wire). Fragments of the funerary headdresses with find number 5918 (individual 5917), 5919 (individual 5931), 6271 (individual 6211), 6478 (individual 6749), and 6591 (individual 6589) were described in this report and appear to be the most noteworthy elements of all excavated funerary headdresses. Because of preservation and conservation, it was not possible to fully determine each metal fragment which may correspond with the funerary headdress (Nooijen, 2016); it would appear that for the remaining individuals the finds were not sufficient.

Even so, different types of decorations were noted in the report for the previously mentioned individuals. The wires used as a 'main' wire were either bent in such a way to create a zig-zag pattern; these wires were also entwined with other wires in a similar matter (fig. 4.65 and 4.66) (Nooijen, 2016, p.138). This type of decoration was documented for the individual with find number 5931 (crown number 5919). Noteworthy was also the pin documented under this crown number; it would appear that 'normal' copper objects may also be present in a funerary headdress (e.g. to fasten textile elements) or generally with an individual buried with a funerary headdress (i.e. used on clothing). From figures 4.65 and 4.66, it can be observed that the characteristic flower or leaf-shaped decorations, as would be expected with Leonic flowers, were not present. This may of course be due to taphonomical processes or preservation; the original shape of the decorations may not be maintained.



Figure 4.65: decorations documented for the individual with find number 5931 (crown number 5919). Note the entwined aspect of the wires, as well as the zig-zag pattern (Nooijen, 2016, p.139).

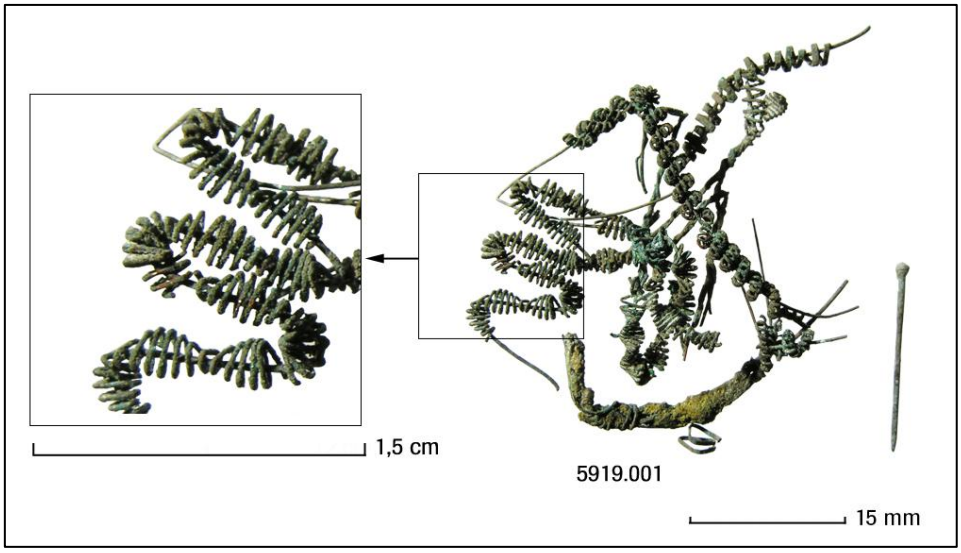

Figure 4.66: other decorations documented for the individual with find number 5931 (crown number 5919) (Nooijen, 2016, p.139).

Decorations made from copper wire, constructed in a more spiral-shaped object were documented for the individual with find number 5917 (crown number 5918) (Nooijen, 2016, p.139). These decorations, still entwined with other copper wire, were constructed with much larger loops of wire (instead of the zig-zag pattern observed for the individual with find number 5931). A piece of fabric can also be observed (fig. 4.67a). Again, these decorations may have had originally a different shape; unfortunately no specific shape can now be observed. For this individual a smilar decoration (spiral-shaped) was again documented, but this decoration also contained small sequins (fig. 4.67b). In addition, as previously presented in paragraph 4.2.1.2 three smaller decorations (and some smaller pieces of loose wire) were documented for this individual during the physical anthropological analysis. These decorations did resemble a Leonic flower; perhaps the decorations displayed below had similar appearances.

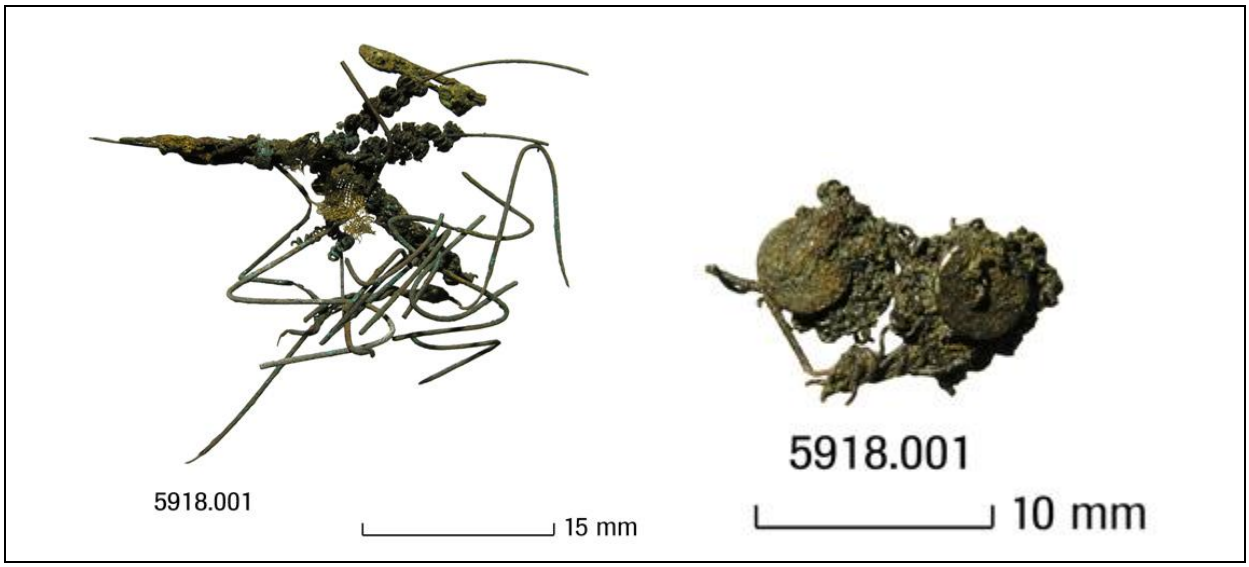

Figure 4.67a, b: left (a): decorations documented for the individual with find number 5917 (crown number 5918). Zig-zag wire also containing a piece of fabric (Nooijen, 2016, p.139). Right (b): also a decoration documented for the individual with find number 5917 (crown number 5918). This element consists of some wires (spiral-shaped) and sequins (Nooijen, 2016, p.128).

Two other types of decorations discussed in the report were elements of bent wire, entwined with wire in larger loops, and parallel wires which appear to be held together by another wire (fig. 4.68a). The latter was documented for the individual with find number 6589 (crown number 6591) and appears to be an element of the funerary headdress that was constructed between two decorations (Nooijen, 2016, p.139). A similar element was also documented for the individual with find number 5917 (crown number 5918); this object was however thicker and somewhat larger (and documented during this study). The other described decoration (bent wire) was documented for the individual with find number 6211 (crown number 6271)(fig. 4.68b). No specific shape could be observed; though again it is very likely the original shape was not

maintained. Additionally, the formed loops resemble the spiral-shaped elements observed for the individual with find number 5917 (fig. 4.67a, b); perhaps these elements were similar decorations.

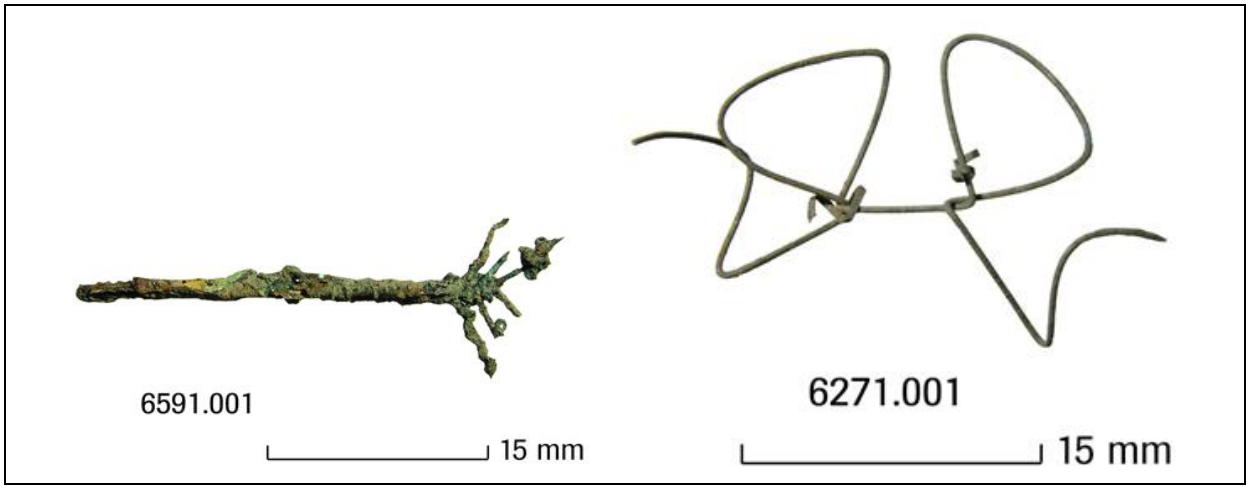

Figure 4.68a, b: left (a): decoration documented for the individual with find number 6589 (crown number 6591); parallel wires entwined by another wire (Nooijen, 2016, p.139). Right (b): decoration documented for the individual with find number 6211 (crown number 6271). This element appears to be formed by entwined wire in large loops (Nooijen, 2016, p.139).

Lastly, only a few decorations have maintained their shape (Nooijen, 2016, p.140) and may give an indication as to what the original decoration consisted of. For the individual with find number 6749 (crown number 6748) an element in a flower-shape was documented (fig. 4.69). The shape of this decoration indicates a Leonic flower; the chemical data was used in order to analyse the absence/presence of Leonic wire as well (see paragraph 5.1.1.3). In addition, the spiral-shaped and zig-zag pattern present in this Leonic flower may also indicate that the previously discussed decorations may had had similar appearances. Additionally, the only other decoration maintaining their characteristic flower shape was the previously discussed element documented during the physical anthropological analysis in this study for the individual with find number 5917 (crown number 5918).

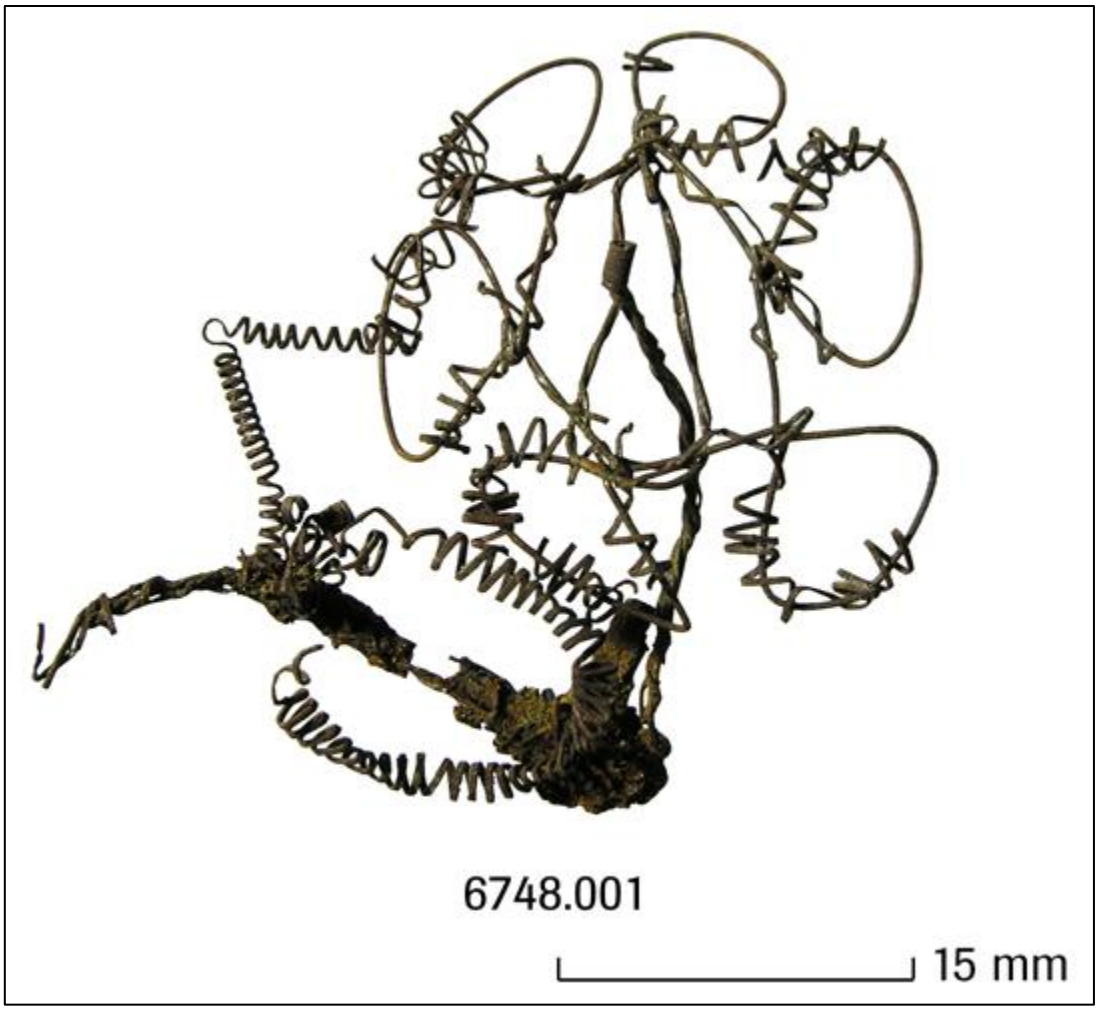

Figure 4.69: decoration (Leonic flower) documented for the individual with find number 6749 (crown number 6748). Note the flower-shaped aspect formed by entwined wire and loops of wire (Nooijen, 2016, p.140).

4.3 Results chemical analysis: XRF

During the chemical analysis, a total of 413 measurements were done with the handheld XRF. This includes also the background measurements, additional measurements (besides green discolorations), and extra measurements (table 4.25). The results of these measurements are presented in the catalogue of the physical anthropological reports (appendix I). In this catalogue, the chemical data are presented for each individual. Variations in chemical compositions, discussion on possible objects/decorations, and comparisons between certain types of data (e.g. chemical composition, location of object) are presented in the subsequent chapter; chapter 5. In addition, chapter 5 will discuss all of the previously mentioned results (material analysis) in order to answer the research questions.

Table 4.25: overview of all XRF measurements, sorted by object/discoloration(s) and baseline/blanks measurements.

Objects measured	**10**
Glass (GLS)	1
Metal (MXX)	8
Residue	1
Discolorations measured (bone)	**241**
Green	214
Blue	9
Iron	7
Organic material + green	5
Black	1
Residue	5
Baseline measurements (bone)	**140**
Blanks/failed measurements	**22**
Total measurements	**413**

5. Discussion

This chapter will put the results into context; locations and chemical compositions of green discolorations will be discussed in regard to the identification of funerary headdresses in archaeological context. The results of the finds, physical anthropological research, and known archaeological and historical data will also be discussed in this regard.

5.1 Identification of funerary headdresses & other objects in Oldenzaal

This study conducted both a material analysis and a chemical analysis on funerary headdresses; the results of which will be discussed in light of identifying a funerary headdress in archaeological context. However, to identify a funerary headdress in the material under study, and therefore also discuss its general identification, it is needed to establish an archaeological definition of a funerary headdress for this study.

The individuals documented with a crown number were used as for the 'crown criteria'. For these individuals the presence of a funerary headdress was already established. The results of the analyses on discolorations, finds, and the chemical analysis will be used in order to establish the archaeological visibility of a funerary headdress. Though these results were used to establish criteria, it should be kept in mind that, because of the possible poor preservation and other taphonomical processes, these criteria may not apply completely to the other individuals under study. Therefore, in addition to the data of the crown individuals, the historical data and archaeological data on funerary headdresses were used to establish these criteria. Adding these data allows to make a more 'broad' definition; meaning the identification of the presence of a funerary headdress depends on certain elements separately or a combination thereof. Using such broad definitions may allow to also identifying the 'invisible' funerary headdresses in archaeological context.

5.1.1 Archaeological definition of a funerary headdress

The individuals under study which were documented with a crown number, and therefore had definitely a funerary headdress present, are displayed in table 5.1. The finds and discolorations documented for these individuals were presented in the previous chapter. They will, however, be also shortly presented here to provide an overview before establishing the crown criteria and are displayed in table 5.2.

To establish the 'crown criteria' based on the analyses of these individuals, the results of the material analysis (both the discoloration(s) and find analyses) and the chemical analysis will be used. When criteria are established separately for the finds (paragraph 5.1.1.1), discoloration(s) (paragraph 5.1.1.2), and chemical composition of residue(s) (paragraph 5.1.1.3), these criteria will be combined in order to identify the presence of a funerary headdress with more certainty (5.1.1.4). Of course, taken into account that a chemical analysis cannot always be conducted, and therefore the established criteria cannot always be used, criteria based on this aspect will be considered separately from the finds and discolorations. Furthermore, the correlation between specific finds and discoloration(s) will also be discussed in order to assume the presence of a funerary headdress in archaeological context.

Table 5.1: overview of the crown individuals documented in this study, with physical anthropological data. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	krn_nr	agecat	sex	age min	age max	AMstat (cm)
1707	1707	Ch	U	1,3	2,6	0
6211	6271	Ch	U	7,5	12,5	0
6260	6361	Ch	U	0	1	0
6373	6392	Ch	U	1	2,8	0
6451	6453	Ch	U	5	9	0
6476	6470	Ch	U	0,5	2,5	0
6478	6479	Ch	U	3	5	0
3797	3791	A	U (F based on DNA)	21	??	0
5917	5918	J	U	18	24	0
4139	4139	A	M	50	65	178,86 ±4,05
4453	5355	A	F	40	80	0
5931	5919	A	F	37,33	43,33	178,93 ±4,45
6589	6591	A	U	21	???	0
6749	6748	A	F	25	30	155,41 ±4,24
6786	6787	A	F	30	60	0

Table 5.2: overview of the crown individuals documented in this study, with skull and postcranial zones. Green (G) areas indicate green discoloration; blue (B) areas indicate blue discoloration; the grey areas (-) indicate zone was inspected but no discoloration documented; light-red (M) areas indicate zone was missing. "F" indicates a documented find for that zone.

	1707	6211	6260	6373	6451	6476	6478	3797	4139	4453	5917	5931	6589	6749	6786
Frontal	-	-	-	G	-	M	M	G	-	B	-	-	M	B/G	B/G
Parietals	-	G	-	G	B	M	B	G	-	B	G	B	M	-	B/G/F
Occipital	-	-	M	-	-	M	M	G	-	B/G	G	-	M	-	B/G /F
Temporals	-	-	-	-	B	M	-	G	-	G	-	B	M	-	B
Max./mand.	M	-	-	M	M	M	-	-	-	-	-	-	M	-	-
Zygo/orbits	M	M	-	M	-	M	M	-	G	-	M	M	M	-	G
Indet.	G		G	G		-	B				G		-		B
Skull general					F		F	F			F				
Upper limbs	M	M	-	M	-	M	-	-	B	-	-	M	M	-	M
Lower limbs	M	M	-	M	G/F	M	-	-	M	-	B	M	M	-	M
Shoulder girdle	M	M	M	M	M	M	-	M	-	B	M	M	M	-	M
Pelvic girdle	M	M	-	M	M	M	-	-/F	M	-	-	M	M	-	M
Hands/feet	M	M	M	M	M	M	-	M	M	-	-	M	M	M	M
Torso	-	M	-	M	M	M	-	-	M	-	-	M	M	M	M
Spine	G	-	-	M	-	M	-	-	-	-	-	M	M	-	M
Remarks		Frag.				Frag.							Frag.		

5.1.1.1 Material analysis: finds

The finds documented during the physical anthropological analysis and further analysis of the material documented under the crown numbers (done by the ADC as previously mentioned (Nooijen, 2016)) were used for the material analysis.

Copper alloy/metal objects

One of the characteristic elements of a funerary headdress, based on data from Germany and archaeological data, would be the presence of these specific Leonic wires and/or Leonic flowers. As presented in paragraph 4.2.9, several decorations were described (n=7; total analysed fragments=158 (Nooijen, 2016, p.138)); though mostly not part of this study. It would appear that the majority of the documented crown elements were fragmentary; the original shape and construction were not always possible to reconstruct and only fragments of wire remained (Nooijen, 2016, p.138-142). Sometimes, the characteristic entwined and braided aspect would still be visible; this was especially true for the described decorations (n=7; see paragraph 4.2.9). Only for one element the original shape, which appears to be a flower-shape, was maintained (Nooijen, 2016, p.140). This was also the case for the decorations (n=3) documented during the physical anthropological analysis; for the individual with find number 5917. Based on data of the funerary headdresses from Germany (Lippok, 2013), these small decorations were possibly Leonic flowers. It cannot be determined if the wires used for these decorations were also these specific Leonic wires; the chemical data may indicate this or contribute to possible chemical composition (paragraph 5.1.3). However, using the data on the funerary headdresses from Germany (i.e. shape and construction) as criterion, this would mean that the majority of the documented decorations cannot be definitely determined as Leonic flowers. Though for some elements the braided and/or entwined construction, as would be expected for Leonic flowers/decorations, was visible, it was impossible to reconstruct these fragments of wire as these specific decorations. Based on this, the criterion to identify any Leonic wire or Leonic flower should be extended; this to also include decorations that are not well preserved or partially destroyed (especially their shape) by taphonomical processes. Therefore, fragments of small, thin (copper) wire that appear to be braided, entwined, twisted, or otherwise constructed with other similar wires to form a decoration may also indicate the presence of a funerary headdress. Moreover, some copper fragments documented for the crown individuals did not resemble a wire or decoration at all; indicating that several types of shapes should be taken into account when identifying a funerary headdress based on copper material (i.e. small sequins as documented for the individual with find number 5917 (Nooijen, 2016, p.139). In addition, for the individual with find number 6589 a smaller, thicker fragment of copper was documented. A similar object was also documented for the individual with find number 5917. Both may probably be an aspect of the funerary headdress (perhaps to combine certain elements) and similar objects should therefore not be overlooked.

For all decorations that still resemble a Leonic flower and the objects that do not, the amount, location, and association with any other type of decoration as well as discoloration(s) should be taken into account. Smaller copper fragments may still indicate (hair) jewellery; the presence of other funerary headdress indicators is of importance for (almost) indeterminable copper fragments. It should also be noted that, depending on possible local variation, 'normal' copper wire was used as an alternative to construct and/or decorate a funerary headdress. Of course not fabricated in Lyon, these 'normal' copper wires can still be coated with silver or zinc (Lippok, 2013), and can be similar in morphology. In addition, aside from the possible usage of 'normal' copper wire, it may be possible that any other type of wire may have been used as decorations or as frame (e.g. iron). For some of the decorations, traces of iron were documented. It would be appear that the frame for the funerary headdress for this individual (find number 6479) was made of iron (Nooijen, 2016, p.140), but it should not be excluded that decorations may contain iron as well. This would mean that even though the appearance of the decorations may indicate Leonic flowers, the chemical composition can vary due to local variation as other types of wires were used. General differences in chemical composition of a wire or decorations may be determined without a specific chemical analysis (e.g. presence of iron and/or copper), but to fully determine the presence of Leonic wires and/or 'normal' copper wires used as decorations in funerary headdresses both the chemical criteria and the finds criteria are needed.

Glass

Described as a common aspect of this burial custom by Portegies (1999) and other historical data, and not associated with any other burial custom, reflective material is also a decoration that can be expected with a funerary headdress. A variation of reflective material is described by both archaeological examples and historical data (e.g. glass splinters, slivers of tinfoil). Using glass splinters as an aspect of this burial custom was also documented for archaeological examples in Belgium, though their appearance is different. Generally, the presence of reflective material was taken into account for the criteria of the finds. Several crown individuals (n=3) were documented with glass fragments; size, appearance, and amount differed for each individual. For the individual with find number 6451 the documented fragments of glass were small and thin, and were present on the tibial shaft and in the soil residue. Their appearance corresponds with the glass splinters documented in Belgium, and with the description provided both by archaeological examples and historical data for the Netherlands. However, it would also seem that larger, thicker fragments can also be present in this burial custom; both the individuals with find number 1707 and 3797 were documented with this type of glass fragments. Though it is likely these fragments were used as reflective decoration, it was not possible to determine with certainty these glass fragments were an aspect of this burial custom, as the possibility exist these fragments are used in 'normal' utensils or window-glass.

In addition, other glass objects should also be taken into account for these criteria. For the individual with find number 1707 additional glass objects were documented during the excavation (Jacobs, 2016, p.129). These decorations appear to be small bead-like objects. These objects were, however, very thin and too small to be indicative of jewellery (Jacobs, 2016, p.129), and were probably associated with decorations of a funerary headdress. Similar objects were documented and report by Lippok (2013) for Germany, and some other archaeological examples in the Netherlands report glass beads as well. Generally, glass appears to be frequently associated with this burial custom and should therefore be included in the criteria for the finds; their appearance taken into account.

Organic material

Organic material also appears to be one of the frequently used decorations associated with a funerary headdress; most archaeological examples and historical data indicate the usage of organic material. Though preservation may limit the view on these organic decorations, their presence should be included in the finds criteria and taken into account.

Organic residue (n=6) was documented during the physical anthropological analysis for the individuals with find number 3797 (1 fragment), 6478 (1 fragment), 6786 (2 fragments), and 4453 (1 fragment). For all these individuals this organic residue was probably hair. For the individual with find number 6749 organic residue was documented during the excavation (Nooijen, 2016, p.140), which indicated that flowers and leaves were present. No artificial (with the exception of the flower-like decorations) flowers were documented for this individual.

The organic material was, however, not present for all of the crown individuals due to preservation. In historical data the usage of flowers (real or artificial), paper, ribbons, and other textile was frequently mentioned. In archaeological data the presence of organic material did not always occur frequently due to preservation. Furthermore, due to fragmentation it may not always possible to determine the organic residue; therefore making the presence of organic material quite difficult to use as a criterion.

Other material

Other finds documented during the physical anthropological analysis were some small copper fragments, small metal fragments (probably nails), and fragments of pottery; these were all documented for the individual with find number 3797. With the exception of the small copper fragments, these finds have probably no association with the presence of a funerary headdress.

Establishing the finds criteria

Based on the documented finds for the previously mentioned individuals in combination with archaeological and historical data (table 5.3), the criteria for finds associated with the funerary headdress burial custom could be established. Especially the presence of Leonic wires/flowers or copper wire/flower-shaped decorations of wire, reflective decoration, and organic residue can be an indicator for the presence of a funerary headdress. It was, however, difficult to establish if the presence of one of these types of finds was associated with a funerary headdress (e.g. glass used in 'normal' objects instead of reflective material), and therefore the presence of discoloration should also be taken into account. For a few of these finds, such as the Leonic wires/flowers, their association with a funerary headdress was certain; the usage of these decorations in other burial customs is not known. These finds, though not always possible to determine with certainty due to local variation or preservation, were defined as 'strong indicators' and will be discussed below.

Table 5.3: overview of expected decorations with a funerary headdress, based on documented finds for the crown individuals and archaeological/historical data.

Inorganic		Organic
Leonic wires/Leonic flowers		Flowers (rosemary; roses)
Copper wires		Paper (ribbon/flower-object)
Iron wires		Silk (ribbon/flower-object)
Beads (glass)		Textile/fabric (ribbon/flower-object)
Smaller metal wires (fringes)		(green) Herbs
Leaf/flower decorations of metal		Leaves
Glass (shreds/splinters)		
Pearls or imitation pearls		
Sequins		

As mentioned, the presence of Leonic wires or flowers was one of these strong indicators. Even without any (green) discoloration or other finds, the presence of these Leonic wires or flowers can indicate a funerary headdress. It should be noted that copper wire or iron wire could also have been used as to create decorations similar to Leonic flowers; these would either be entwined and/or in flower/leaf-shapes. In addition, 'normal' copper wire or iron wire could also have been used for the frame. Both should also be considered as a strong indicator for the presence of a funerary headdress. Fragments of Leonic wires and/or any other type of wire that may have been braided or entwined to form a decoration, but the specific flower or leaf shape was not maintained, are also a strong indicator for a funerary headdress; however other types of finds and/or discoloration(s), as well as the amount and location of these fragments should be taken into account for indeterminable fragments.

Another strong indicator of a funerary headdress is the presence of glass, or reflective material in general. This does not include the glass used in 'normal' objects or window-glass, though it appears it may be possible larger and thicker fragments of glass were also used in this burial custom as reflective material. However, the most common type of glass fragments in this burial custom is small, very thin, and coloured glass. Though not frequently retrieved from archaeological context because of size, this type of decoration is certainly only associated with this burial custom and therefore a very strong indicator for the presence of a funerary headdress.

The presence of copper or iron residue(s) (not discoloration) near the skull can also be a strong indicator for the presence of a funerary headdress. These inorganic residues were, however, frequently in combination with organic residue or some other inorganic residue and should therefore also be taken into account. The organic residue present can be from paper, leaves, or flowers; the inorganic residue can be objects such as beads, pearls, or smaller metal objects (fringes). Of course, copper or iron residue(s) in combination with the two aforementioned strong indicators (i.e. Leonic wires, glass) can also indicate the presence of a funerary headdress.

The other inorganic finds presented in table 5.3 cannot be used as a strong indicator for the presence of a funerary headdress; it was therefore defined as a weak indicator. The decorations such as beads, pearls, or sequins can be used for other purposes in burial customs as well and are not solely associated with the presence of a funerary headdress. Though some of these elements were documented for the crown individuals, it is not possible to use the solely presence of, for example, pearls to indicate a funerary headdress; unless these decorative ornaments are in combination of any aforementioned strong indicators of a funerary headdress. In addition, smaller, indeterminable inorganic finds which may have been an aspect of the funerary headdress are a weak indicator as well. Unless determinable as a decorative object and/or aspect of the funerary headdress (e.g. the thicker copper objects or the sequins

documented for the individual with find number 5917) or in combination with a strong indicator, these objects cannot indicate the presence of a funerary headdress with certainty.

The organic finds presented in table 5.3 (e.g. paper, flowers, leaves, etc.) are, because of the frequently poor preservation of organic material, also a weak indicator. This is also because organic material is often associated with the presence of metal residue; which was already established as a strong indicator. In addition, it is also possible that organic material was used for other purposes in the burial custom; clothing, beautification of the deceased (with or without a funerary headdress), or textile used in the coffin. It is therefore difficult to use organic material as a strong indicator for the presence of a funerary headdress. As a criterion used in this study the organic material should be in combination with either the aforementioned strong indicators, copper/iron elements/residue, or discoloration(s) on the skull (see paragraph 5.1.1.2).

5.1.1.2 Material analysis: discoloration

Archaeological evidence for the presence of a funerary headdress is often the remaining (green) discoloration on skeletal material. Therefore, the location and amount of (green) discoloration are of great importance to indicate the presence of a funerary headdress. However, solely looking at the discolorations documented for the individuals presented in table 5.1, it becomes clear that for the young individuals - especially the individuals estimated to be younger than 2 years - the discoloration(s) were scarce or completely absent (table 5.2). This may be due to the fact that the skeletal elements of the young individuals were very fragmented and in addition it was not always possible to determine the skeletal element due to preservation. The high amount of fragmented skeletal elements also results that not each skeletal region is fully represented. Moreover, it was not always possible to recognize not fully grown skeletal elements or reconstruct skeletal regions. For the first three individuals presented in table 5.1, individuals with find number 6260 and 1707 only a few discolorations were documented on indeterminable skull fragments. However, for the individuals with find number 6476 and 6589 (adult individual) no discolorations were documented during the physical anthropological analysis of this study due to fragmentation and preservation.

Scarce discoloration(s), though on determinable locations, were documented for the individuals with find number 4139, 5931, 6211, 6478, and 6749. Individual with find number 4139 is an example of how a funerary headdress may not leave discolorations at all on the expected areas (e.g. the parietals and the frontal); this individual was documented with green discoloration on the right zygomatic (small area of green discoloration on the posterior surface). For the individual with find number 5931 only diffuse blue discoloration was documented on the skull; the funerary headdress did not leave any green discoloration and could therefore not be recognized completely. For both these individuals, taphonomic and decomposition processes may explain this variation; it should, however, be noted that these processes may have also affected other individuals and therefore influence the archaeological visibility.

As can be observed in table 5.2, for most of the individuals (n=7) scarce discolorations were documented. In addition with the two aforementioned individuals, these individuals illustrate that a funerary headdress is a present, but absent or scarce discoloration is observed or present at unexpected regions. This does indicate that it is quite difficult to establish the presence of a funerary headdress solely based on discoloration(s).

However, for the remaining individuals presented in table 5.1 and 5.2, sufficient discolorations and/or patterns in these discolorations were documented. The individual with find number 5917, for example, was documented with large areas of green discoloration present on the occipital and parietals; areas which may be possible to associate with the location of the funerary

headdress. The additional chemical data, as will be discussed in paragraph 5.1.1.3, can give more insight on this aspect.

The individual with find number 4453 was documented with green discoloration on the occipital and the right temporal; on the right temporal some organic residue (hair) was also present. For this individual only the skull was present; so other locations of discoloration (postcranial) were limited to analyse. This in slight contrast with the individual with find number 3797; this individual was documented with green discoloration which enclosed the skull (see *patterns of discoloration*) and though all skeletal areas were represented, this individual was very fragmented. Another individual documented with a pattern (see *patterns of discoloration*), and also poorly preserved, was find number 6373. The green discolorations on the skull (frontal and parietal) were present in various oval-shaped patterns, which resemble the decorations made of Leonic wires.

The individual with find number 6786 was documented with ectocranial and endocranial green discoloration. This was present on the frontal, on top of the skull, the right parietal, and the occipital; all of these areas were diffuse. Furthermore, this individual was documented with a diffuse blue discoloration all over the skull. Diffuse blue discoloration was also present on the individual with find number 6451.

Overall, it seemed that the preservation of the skeletal material, which results in indeterminable skeletal elements or lack of skeletal material, limited the possibilities to indicate the presence of a funerary headdress based on discoloration(s). It would seem that this mostly affects the determination of funerary headdresses in (very) young individuals, as these individuals were not always very well preserved and determination of skeletal elements was difficult. It would seem therefore that the presence of a funerary headdress cannot be assumed solely based on the presence, and also the location, of discoloration. This is of course unless a distinct or partial pattern is present; therefore the patterns of discoloration(s) will be discussed below. It should be noted that for this criterion only the presence and location of green discoloration was discussed. Of course, for a few individuals blue residue was documented on skeletal elements. Though no specific pattern, shape, or location was observed during the initial analysis, this blue residue and possible association with a funerary headdress will be discussed in paragraph 5.1.1.3 (chemical data for the crown individuals).

Patterns in discoloration

Based on the locations and combination of discolorations, for only 5 individuals a distinct pattern could be observed which indicates the presence of a funerary headdress. In the results chapter, 5 different patterns were observed in the complete selection under study (1= frontal

and parietals area; 2= top of head and parietals area; 3= occipital and parietals area; 4= enclosing the complete skull; 5= area of the mouth). Using this system, table 5.4 presents the crown individuals documented with one of these patterns in discolorations.

Table 5.4: overview of the individuals documented with a pattern type, as well as the areas containing green discoloration(s).

Pattern type	Crown individual(s)	Areas of discoloration
1	6373	frontal, left parietal
2	none	
3	4453	temporal R, occipital
3	5917	parietal L+R, occipital
4	3797	frontal, parietal L+R, temporal R, lambdoidal suture
4	6786	frontal, orbit R, parietal R, occipital
5	none	

Postcranial bones

Only three individuals in the selected population were documented with green discoloration on postcranial bones; one individual (find number 4139) was documented with blue residue on the right humerus. For the individual with find number 1707 the green discoloration was present on the neural arches, indicating that an object of copper was present on or near the back of this individual. The other individual, find number 6451, was documented with green discoloration on both tibiae. For this individual only blue discoloration was documented for the skull. The lack of green discoloration on the skull may indicate the usage of only organic material around the skull, or the usage of only a wreath on postcranial locations. This illustrates that any discoloration(s) on postcranial bones should also be taken into account when establishing the presence of a funerary headdress.

Establishing the discoloration criteria & patterns

Though not all crown individuals were documented with a distinct pattern or sufficient discoloration(s) it was still possible to establish criteria; this in combination with historical and archaeological data on funerary headdresses. The location(s) with green discoloration on the crown individuals that occur most frequently were the parietals, frontal, and the occipital; the combination and simultaneously occurrence of these discolorations differed. Taken archaeological and historical data into account, it would appear that it can be expected that a funerary headdress can resemble (a) a diadem, (b) a wreath, and (c) a cap-like element. As Lippok (2011) already noted, a diadem would leave remnants on the frontal and the parietals area, and therefore corresponds with pattern 1. The remnants of a wreath would, however, be dependent on the location of the wreath, as well as whether or not the wreath was fully closed. Historical data indicate a frequent use of a wreath near the head and/or near the shoulders; therefore discoloration on top of the skull, as well as the parietals area and perhaps the occipital

may be possible (pattern 2 and/or 3). It would also therefore mean that the wreath would not be fully closed, as it is also mentioned in historical data that an 'arch' of flowers was used. A difference in the location of the arch can be observed based on the presence of patterns 2 and 3. For pattern 2, the arch would be located from shoulder to shoulder, with the top of the arch resting on top of the skull. For pattern 3, the arch would be located on the back of the skull; the individual would be lying on this arch in order for this pattern to be present. Because of these differences between the patterns 2 and 3, the arch type is divided up in A and B. Lastly, a cap-like element may also leave residue on the areas of the parietals and/or the occipital, or enclose the complete skull (pattern 2, 3 and/or 4); it may be difficult to differentiate between a cap-like element and a wreath near/around the skull. The discussed patterns and corresponding crown type(s) are presented in table 5.5. As the crown individuals in this study have indicated that variation (taphonomical or decomposition processes), lack, and scarce discoloration is possible, it should be noted that these discussed patterns in discoloration are guidelines.

Table 5.5: overview of the discussed pattern numbers and the corresponding discoloration(s) on skull areas, as well as the appointed type.

Pattern number	Discoloration on areas	Crown type
1	Frontal, parietals, temporals	Diadem
2	On top of skull, parietals, temporals	Wreath: arch A
3	Parietals, temporals, occipital	Wreath: arch B
4	Frontal, parietals, temporals, occipital	Wreath or cap, around head

As discussed, the presence of discoloration cannot always be conclusive about the presence of a funerary headdress. For two crown individuals, no discoloration was documented at all (find numbers 6476 and 6589), even though a funerary headdress was documented. It should therefore be taken into account that a funerary headdress may not always be visible in the presence/amount of discoloration(s). The other crown individuals have illustrated that certain types of discoloration on certain locations can, however, indicate a funerary headdress; this was only possible if sufficient (green) discolorations were present.

Regarding the discolorations, the criteria in this study is that at least one of the patterns presented in table 5.5 should be present; or at least an indication that a type of headgear was present (partial pattern/green discoloration which can be correlated to each other). Of course, taken into account that preservation may not be perfect, and/or the presence of fragmentary material, this criterion is somewhat broadened to include the more 'invisible' funerary headdresses as well. This means that relatively large areas of green discoloration should be at

least present at two locations on the skull; preferably in the orbits/frontal area and/or the parietals area in order to be indicative of a funerary headdress. Discoloration(s) in the areas of the occipital can also be associated with the presence of a funerary headdress; again the shape and size of the specific green discoloration should be taken into account.

As for size and shape, a funerary headdress frequently consists of multiple decorative elements; as all of these decorative elements can contain (a) copper (alloy), the crown may leave large or diffuse areas of discoloration(s) on human skeletal material. Smaller and concentrated areas may indicate the usage of smaller copper alloy objects on/around the skull (e.g. pins, coins). The presence of large areas of green discoloration at multiple locations on the skull, or on multiple skull fragments, may indicate the presence of a funerary headdress. As for shape, it was observed in the individual with find number 6373, that the funerary headdress may leave distinct shapes in green discoloration (e.g. oval or round shaped).

The green discoloration documented for the crown individual was mostly present on the skull (n=10 of all skulls possible to analyse (n=13)) and indicated that this area is frequently affected. However, the discoloration on postcranial bones should also be considered (e.g. the green discoloration on the tibiae of the individual with find number 6451). Archaeological data indicate that the presence of funerary headdresses, or decorations related to these, can be present on postcranial bones. Historical and archaeological data indicate the frequent usage of 'normal' copper alloy objects (e.g. pins, buttons) in postcranial regions; it is therefore quite difficult to differentiate between the 'normal' objects and the remnants of a funerary headdress. Even so, a funerary headdress may also be located in the hands - sometimes even near the feet - therefore, green discoloration in these areas can be associated with the presence of a funerary headdress. Again, large areas of green discoloration are more indicative of a funerary headdressthan the smaller areas. The combination of discoloration on postcranial bones and on the skull should be analysed; though the presence of discoloration(s) on the skull are more indicative of the presence of a funerary headdress than any discoloration(s) on postcranial bones.

5.1.1.3 Chemical analysis

As mentioned in the research outline (chapter 1), chemical analyses were conducted to obtain data on the chemical composition of a funerary headdress. With these data it was tested if it was possible to identify the funerary headdresses based on their chemical composition; i.e. identify specific decorations, such as Leonic wires. Moreover, the data on the chemical composition of a funerary headdress was also combined with data on the chemical composition of the (correlating) (green) discoloration on human skeletal material. This was done in order to test the possible correlation between the decoration and discoloration and whether only the chemical composition of the discolorations could identify a funerary headdress. In addition, the results of the chemical analysis were also compared with other data (e.g. sex and age estimations) in order to analyse possible correlations (e.g. specific chemical compositions of discoloration(s) in certain skeletal regions).

This paragraph will only discuss the chemical data documented for the crown individuals in order to establish possible criteria. Besides the chemical data on the (green) discolorations, additional data for the crown individuals was available; these were the chemical compositions of the funerary headdresses and decorations. However, the individuals with find number 6476 and 6589 were excluded from the chemical analysis as no discolorations were documented for these individuals; therefore no comparison between the funerary headdress and the discoloration(s) could be made. In addition, it should be noted that for some of the crown individuals these chemical data were overall limited if the analysed discoloration was only present on (a few) indeterminable skull fragment(s).

The chemical data for all other individuals and discussion regarding this will be presented in paragraph 5.2.1.4.

Chemical data: the (green) discoloration(s)

The chemical data will be discussed with a focus on copper (Cu) and zinc (Zn). The combination of Cu and Zn is one of the most frequently occurring alloys of copper (brass), and discussing the variation in the ratio of Cu/Zn in the (green) discoloration(s) may allow distinguishing specific objects. The copper alloy brass contains approximately 28% Zn, meaning the ratio of Zn/Cu is approximately 1:3. Furthermore, other elements present in the chemical data will be discussed; the presence of silver may indicate jewellery or Leonic wires. The plot in figure 5.1 presents the measurements taken in the skull region and in postcranial region(s), with a line defining the 1:3 ratio of brass. Unfortunately, only 5 measurements were taken in three postcranial regions; the spine, lower limbs, and upper limbs. Because of the low amount of chemical data for postcranial regions of the crown individuals, these data will be discussed in combination with the chemical data on the skull regions. The data presented in figure 5.1 show various Cu/Zn

ratios for the analysed discoloration(s), though it was possible to distinguish at least two groups; group 1 for which the Cu/Zn ratio indicate brass and group 2 for which the Cu ratio is relatively higher.

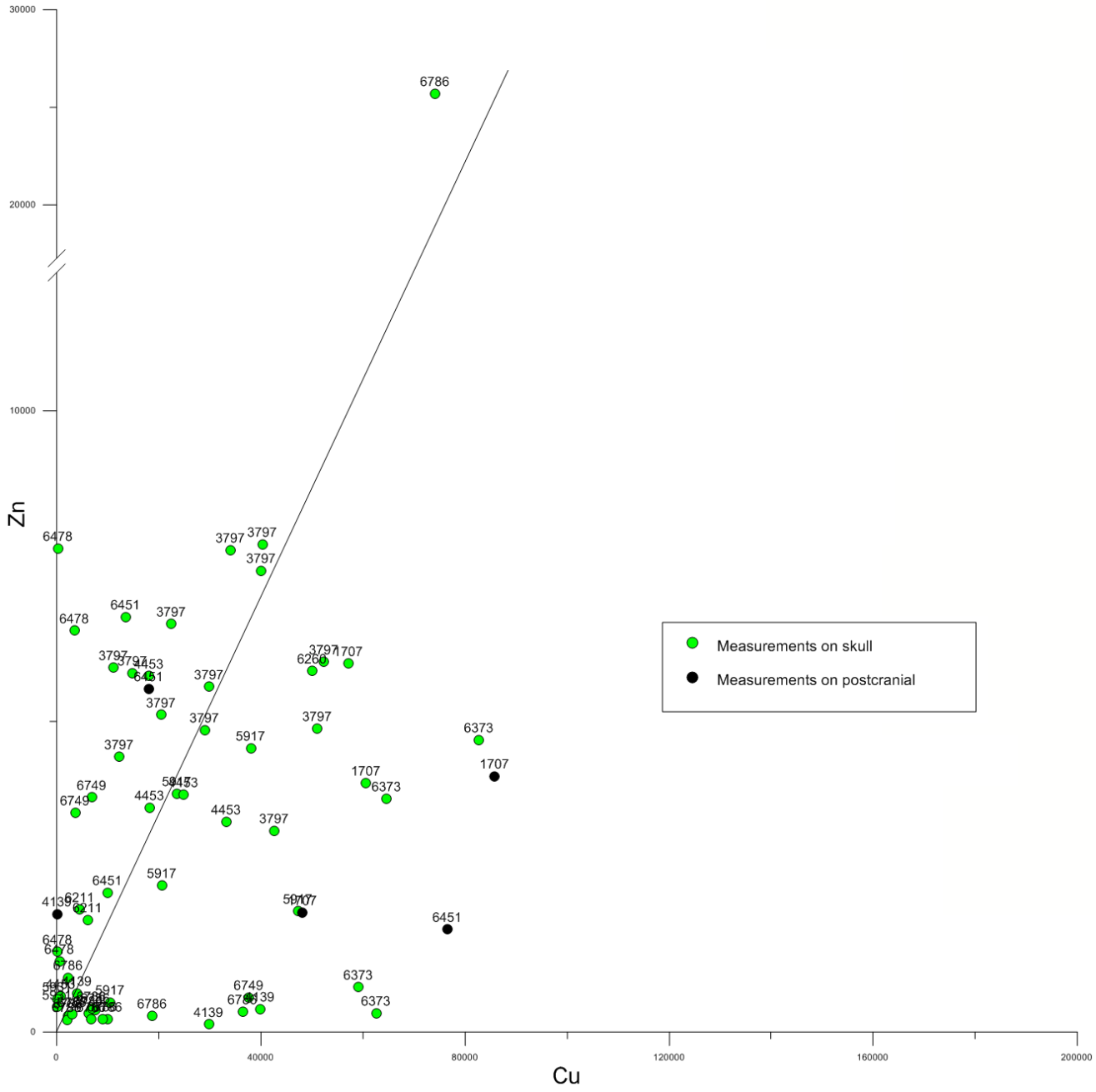

Figure 5.1: scatter plot of Cu/Zn ratios on the skulls and postcranial locations (crown individuals). The black line indicates the 1:3 ratio; measurements around this line belong to the brass group.

Low Cu-Low Zn

Besides these two observed groups, it was also noted that for 6 individuals some (green) discoloration or residue did not contain any amount of Cu and/or Zn, or this was only slightly present. The individuals with find number 6451 and 6211 had both green discoloration on a parietal containing a low amount of Cu and Zn, and no other elements were present in significant high amounts. Furthermore, most of the measurements taken on skull fragments of the individual with find number 6786 also contained a low amount of Cu and Zn. Measurements for the individuals with find number 4453, 5931, and 6478 also indicated a low amount of Cu and Zn; these measurements were, however, taken on blue residue and will be discussed later.

Middle group: brass

As can be seen in figure 5.1, the majority of the analysed discolorations fall in the specific ratio of brass. Therefore, it may very likely be that the majority of objects present on and/or around the skull for the crown individuals were made of brass; no postcranial discolorations contained any Cu/Zn ratio similar to brass. Objects of brass may have been functional objects, such as the previously discussed pins and buckles. Therefore, even though the chemical data for the postcranial regions were limited, it was expected that the postcranial discolorations would reflect brass ratios as functional objects (e.g. buttons) may have been present in these regions. However, besides its frequent use as copper alloy for all types of 'normal' objects, brass can also be present in the decorations of the funerary headdress and its gold-like appearance may have been aspect in its usage in the burial custom of the funerary headdress. Several examples from the archaeological dataset exist of brass decorations or the usage of zinc as coating (e.g. brass metal fringes or brass wire (Lippok, 2013).

Using the analysed discolorations in the brass ratio, it was unfortunately not possible to distinguish between these brass ratios any further based on slight differences in the Cu/Zn ratios. It was therefore not possible to differentiate between the 'normal' objects any further. In addition, solely based on the chemical data for the discoloration(s) it was not possible to distinguish between the 'normal' objects and the possible decorations of brass related to a funerary headdress; each type did not have a specific ratio based on which it could be identified. Therefore, as no definite conclusions could be made, the presence of 'normal' objects may also be a possibility for these individuals as these objects could have been present simultaneously with a funerary headdress (e.g. pins to secure clothing).

High Cu: jewellery?

However, some of these measurements fall outside this specific brass range as a higher amount of Cu was present. One measurement, taken on the left parietal of the individual with find number 6373, contained the highest amount of Cu amongst the measurements of the crown

individuals. The other measurements taken on the skull of this individual (frontal, indeterminable skull fragment, and on a different area of the left parietal) all also contained a high amount of Cu, though less Zn. Another individual for which all of the analysed green discoloration also contained a high amount of Cu, was find number 1707. Besides the green discoloration on a skull fragment, other green discoloration documented for this individual was located on the spine. All individuals documented with green discoloration(s) containing a high amount of Cu are presented in table 5.6.

Remarkably, the green discoloration on the right zygomatic-temporal process of the individual with find number 4139 only contained a relatively high amount of Cu, and a very low amount of Zn. No other elements were present in a sufficient amount to indicate a possible other alloy or chemical composition (i.e. tin); this was also the only discoloration documented for this crown individual.

Table 5.6: overview of the individuals with discoloration(s) containing a high amount of Cu.

Find number	Skeletal element	Other areas of discoloration?
1707	Neural arch (2x), skullfragment (2x)	
3797	Frontal	Around the skull, but these contain lower amounts of Cu
4139	Zygomatic R	Blue residue on right shoulder
5917	Skullfragment	Parietal left and right, containing lower amounts of Cu
6260	Skullfragment	
6373	Parietal L (2x), frontal, skullfragment	
6451	Tibia R	On skull and left tibia, but containing lower amounts of Cu

As discussed above, the high amount of Cu in the analysed green discoloration may indicate the presence of jewellery, or decorative objects in general. It may be possible certain decorations contained such high amount of Cu, aside from the usage of brass as decorations; comparing the chemical data of the funerary headdresses with these data may confirm this (see below). Furthermore, the usage of decorations and/or jewellery in postcranial regions should apparently not be overlooked and taken into account (i.e. the individuals with find number 1707 and 6451).

Other elements

Most analysed discolorations of the individual with find number 6786 contained a high amount of silver (Ag). As mentioned before, these discolorations have, remarkably, a relatively lower

amount of Cu and Zn present. In addition, a high amount of Ag was measured for two other individuals; find number 3797 (parietal left) and 4453 (frontal fragment). For the latter individual, the Ag was present in blue residue (see below).

Blue residue

A few individuals were documented with blue residue during this study; the individuals with find number 4453, 5931, 6451, 6478, 6749, and 6786. For the latter individual this blue residue was documented as 'diffuse' and was therefore not measured. Generally, the blue residue was included in the chemical analysis to research its possible correlation with a funerary headdress and to research its chemical composition in general. Remarkably, the blue residue documented for the individual with find number 4453 (frontal) also contained a high amount of silver, as previously mentioned. The amount of Cu and Zn was, however, relatively low. A similar Cu/Zn ratio is visible in the other measurements for the aforementioned individuals, though the Zn value was higher. Therefore, the blue residue contains frequently a high amount of Zn, but rarely any high amount of Cu. In addition, with the exception of the individual with find number 4453, no other elements appear to be present.

The ratio of Cu/Zn present in the blue residue does not correspond with any of the aforementioned ratios present in the other discolorations, making it difficult to associate these blue discoloration(s) with the presence of a funerary headdress. However, for the individual with find number 5931, blue discoloration was the only discoloration documented, but, as discussed in paragraph 4.2.9, several decorations were documented as well during the excavation. These decorations, which contained a high amount of Cu as well as Ag, were not reflected at all in the (blue) discoloration; therefore making it difficult to associate the funerary headdress with the documented blue discolorations.

Lastly, it is remarkable that the documented blue discolorations in this study were only present on crown individuals. This would imply that this type of discoloration may be associated with a funerary headdress; however as previously discussed the difficulty in corresponding this with a funerary headdress and the different chemical composition of these discoloration(s) contradicts this. No definite conclusions can be made regarding this.

Chemical data: funerary headdresses and comparison of discoloration(s)

The chemical data obtained from measurements on the funerary headdresses of these individuals were compared with the chemical data from the discolorations. As for the individuals with find number 6476 and 6589 no discoloration(s) were documented, no comparison of chemical data between the funerary headdress and discoloration(s) could be made. Additional chemical data was available for the individual with find number 5917; the

fragments of the funerary headdresses documented during the physical anthropological analysis were also chemically analysed and could be compared to the other measurements on the funerary headdresses.

Silver (Ag) and gold (Au)
The presence of silver (Ag) was established in all of the analysed funerary headdresses. For 7 funerary headdresses, the amount of Ag was documented as 'very high' (more or near 1%) and for the remaining funerary headdresses (n=7) the amount of Ag was slightly lower than 1% (0,13-0,74%). The fact that Ag was observed in the chemical data may indicate that the analysed copper wire was coated with silver. If this was the case, it may very likely be that all of the analysed funerary headdresses were constructed with Leonic wires or wires with similar chemical composition. Remarkably, the measurements on the decorations documented during the physical anthropological analysis for the individual with find number 5917 showed a lower amount of Ag than the previously analysed funerary headdresses, making it difficult to determine these specific decorations as Leonic wires with certainty. In addition, gold (Au) was documented for 4 funerary headdresses (approximately 0,1-0,3%); this always in combination with silver. Even so, no significant amount of Au was measured in any of the discolorations documented for the crown individuals.

The individuals with find number 3797, 4453, and 6876, all of which had a funerary headdress with a (very) high amount of Ag, were the only individuals with discolorations which also contained a high amount of Ag (as previously mentioned). Based on the presence of Ag, it was therefore for these individuals possible to correlate the chemical data of the crown with the chemical data of the discolorations and also to conclude that the discoloration on the skull can indeed reflect the chemical composition of the funerary headdress to some extend. This was, however, not true for the remaining individuals; no other discolorations were documented with a (very) high amount of Ag. Ag was, however, measured in very low amounts; but not to such extend that it could be identified in the chemical data for the discoloration(s). This would indicate that Ag from the decoration(s) is poorly reflected in the discoloration(s); making it difficult to identify the presence of Ag, and therefore possibly a Leonic wire/flower, solely based on the chemical data of discoloration(s).

Cu/Zn ratio
The amount of Cu measured in the funerary headdresses was all high (60-97%), whereas the amount of the Zn in the funerary headdresses was low (0%-5%); indicating that the analysed wires from the crowns were probable not made of brass. Additionally, for 8 of the analysed funerary headdresses the Zn was barely present in the alloy (less than 0,2%), and tin (Sn) was also not present. This would mean that the funerary headdresses and associated decorations

would fall in the previously discussed high Cu group. It should be noted, however, that only fragments of the funerary headdresses were analysed; other possible decorations were not preserved and could not be analysed. Additionally, the decorations documented during the physical analysis for the individual with find number 5917 showed a lower amount of Cu, though for some the Zn value was somewhat higher.

As can be seen in figure 5.1, the only measurements which contained a relatively high amount of Cu and almost no Zn, and would therefore correspond with the Cu/Zn ratio of the funerary headdress, were taken on discoloration(s) from the individuals with find number 4139 (right zygomatic), 6373 (frontal), 6451 (postcranial), 6749 (frontal), and 6786 (one measurement on the frontal). With the exception of the individual with find number 6373, these individuals had also other discolorations that did not correspond with the funerary headdress (brass or low Cu/Zn values) at all, making it difficult to establish the presence of a funerary headdress with certainty. In addition, the measurements of the other individuals in the high Cu group (1707, 3797, 5917, and 6260; as previously mentioned) did, based on Cu/Zn ratio, not correspond completely with the measurements on the funerary headdress. Based on the high amount of Cu it was expected that these would correspond; however the amount of Zn was higher in the discoloration(s) than in the analysed funerary headdress.

Since the other individuals had discolorations containing a Cu/Zn ratio which was similar to brass or a low amount of Cu and Zn was present, this would mean that the chemical data for the funerary headdresses and the correlating discolorations do not correspond; the ratios of Cu/Zn are not properly reflected in the discolorations. This may be the result of a process called selective leaching. With selective leaching, the Zn present in a copper alloy may leach from the alloy and deposited elsewhere. Possibly, Zn was present in the funerary headdresses (then probably made of brass wire), but leached into the bone. This resulted in a chemical composition of the crowns with less Zn than originally was present; in addition the discoloration(s) reflects a chemical composition containing relatively more Zn than Cu. Conclusively, the discolorations will not reflect the chemical compositions of the crown properly. This may also explain the different Cu/Zn ratios in the analysed decorations of the individual with find number 5917. It can, however, not be definitely concluded that selective leaching was present; it may also be possible that the funerary headdresses contain relatively a low amount of Zn and the discoloration(s) represent other used decorations.

Remarkably, for some of these individuals the chemical data for the discoloration did correspond with the chemical data for the funerary headdresses. This would indicate that the possible effect of selective leaching can also vary within a burial, possibly also within certain decorations (e.g. the decorations documented for the individual with find number 5917).

However, the variation in chemical compositions of different decorations may also indicate the usage of a variety of objects (e.g. brass, copper wire, Leonic wires) in a funerary headdress. Given these data, it is therefore difficult to establish a correlation between the discoloration and the funerary headdress, at least based on only a few measurements/objects.

Chemical data green discoloration: possible patterns?

The chemical data for the discolorations were further analysed in order to research possible differences in skull regions, patterns, and/or the sex and age estimations. Possible differences between the chemical composition of the discoloration(s) and these aspects may contribute into establishing the criteria.

Skull regions

In figure 5.2, all of the measurements for the crown individuals are displayed; these are the measurements taken at different skull regions (e.g. frontal, lateral left). Most of the measurements fall in the Cu/Zn ratios of brass, though there are outliers present. However, the majorty of the skull regions is represented in the brass ratio, and no specific distribution in the chemical composition and specific skull regions could be observed. Therefore, it is very likely that no specific objects were used for specific regions of the head. It should be noted that the individual with find number 3797 is an exception; for this individual the discoloration on the frontal contained more Cu than for the other measured skull regions. As this individual was also documented with a specific pattern of discoloration (#4), this will be further discussed below.

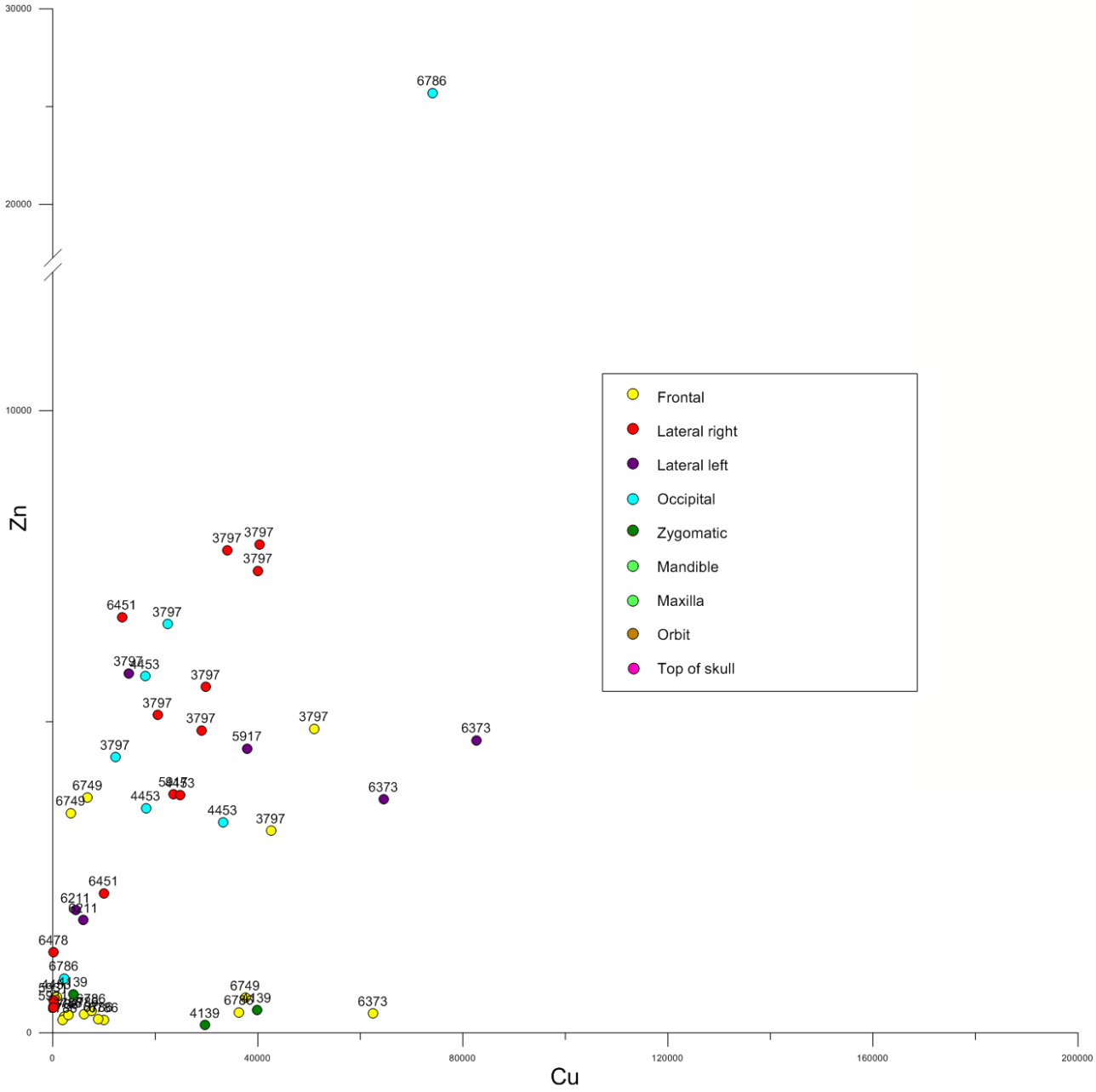

Figure 5.2: scatter plot of Cu/Zn ratios on the skull (crown individuals); sorted/selected by skull region.

Patterns in green discoloration

Figure 5.3 presents the measurements for the crown individuals with a pattern type. Unfortunately, only 5 crown individuals were documented with a pattern. This results in a lack of chemical data for the pattern types. The specific pattern types and possible differences in their chemical composition can be analysed; however no definite conclusions can be made. The individual with find number 6373 was documented with the pattern type 1, and as previously discussed the analysed discolorations indicated a high amount of Cu. The individuals documented with the pattern type 2, find numbers 4453 and 5917, had, however, discolorations that fall mostly in the Cu/Zn ratio of brass (with the exception of an indeterminable skull fragment of the individual with find number 5917). The individual with find number 3797 was documented with pattern type 4. As mentioned, the measurements on the frontal all contained a higher amount of Cu, whereas the other skull regions for this individual contained the Cu/Zn ratio for brass. However, the individual with find number 6786 was also documented with pattern 4, though all of the measurements did, as previously mentioned, contain a low amount of both Cu and Zn, Ag was however also present for some measurements. The presence of Ag was, however, not specifically present for one pattern; both the individuals with find number 4453 (pattern 2) and 3797 were documented with discoloration(s) containing Ag, and both were on a different area.

Both pattern 1 and pattern 4 appeared with discolorations on the frontal, and for both these patterns a relatively higher amount of Cu was observed on the frontal (and on all locations for the individual with find number 6373). It can be discussed that therefore decorative objects would be more frequent for the frontal area; unfortunately, there were no sufficient data on this aspect to establish any definite conclusions.

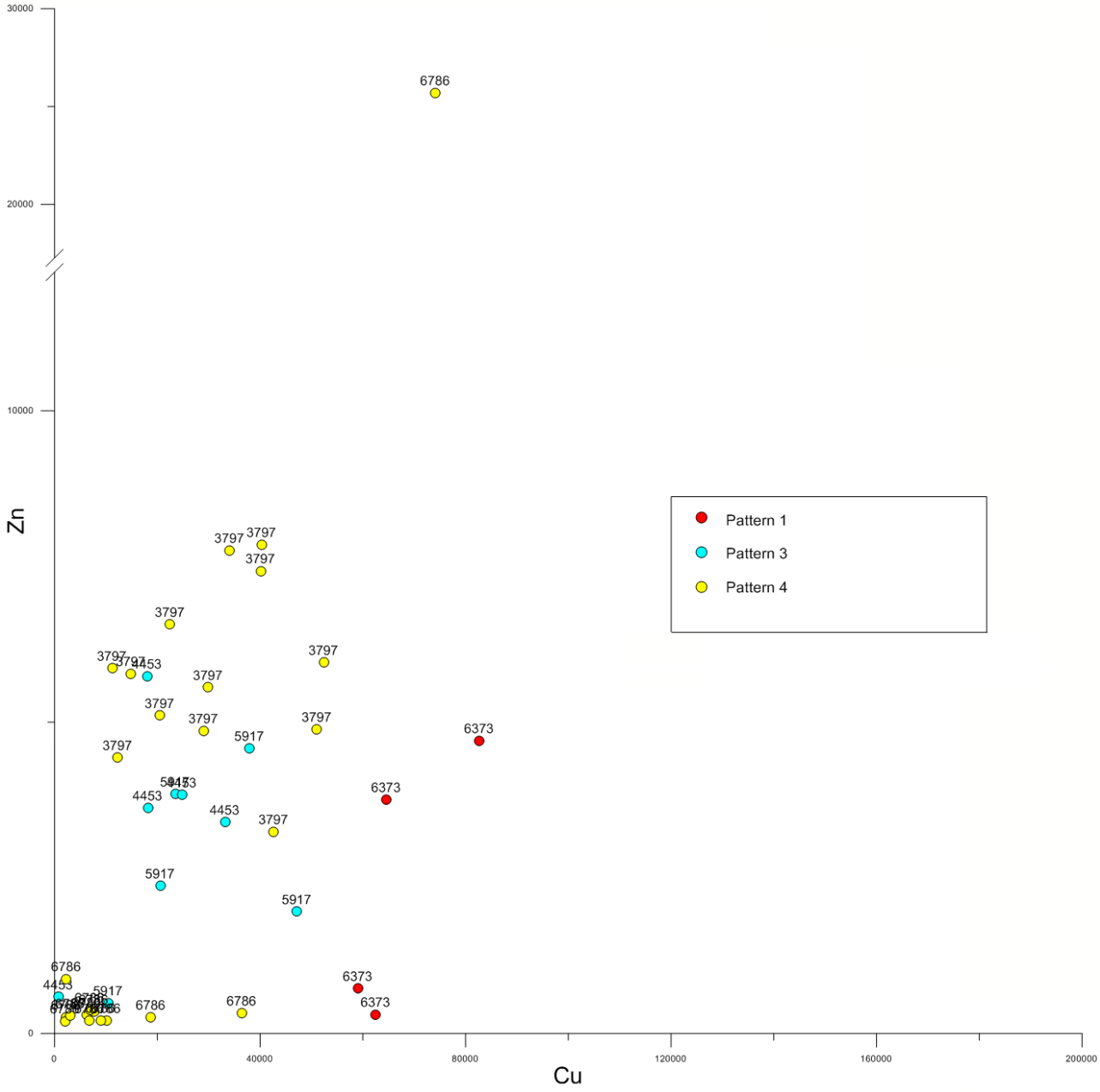

Figure 5.3: scatter plot of Cu/Zn ratios taken on the skull (crown individuals); sorted/selected by patterns.

Other data: age estimation & sex estimation

To analyse possible differences in the usage of certain objects and the age estimations, as well as the sex estimations, these data were compared. In figure 5.4, the chemical data are sorted and presented by age category. The outliers are, remarkably, the measurements from green discolorations documented on very young individuals (age category child, n=7, 6 measured). It appears that for this age category probably no brass objects were present, as none of the measurements fall in the previously discussed specific range for brass. A few discolorations do, however, contain a low amount of Cu and Zn; these were documented for the individuals with find number 6211, 6451, and 6478. The measurements of discolorations documented for young adults (YA, n=2, all measured) and the adults (V, n=6, 5 measured) all fall in the ratio of brass or had a low amount of Cu/Zn present. There are only two outliers, which contain a higher amount of Cu; these are the previously discussed individuals with find number 3797 and 5917 (respectively an adult (no specific age estimation) and a young adult). Moreover, the high amount of Ag appears to be only present in the adult group; this was documented for the individuals 3797 (>21 years), 4453 (40-80 years), and 6786 (30-60 years). Whether both these differences between the young individuals and adult individuals were related to age or preservation cannot be concluded.

Data on sex were limited for the crown individuals due to preservation and the young individuals present in this group. Furthermore, 5 individuals were estimated to be female, and only one individual was estimated to be male; therefore no comparison could be made.

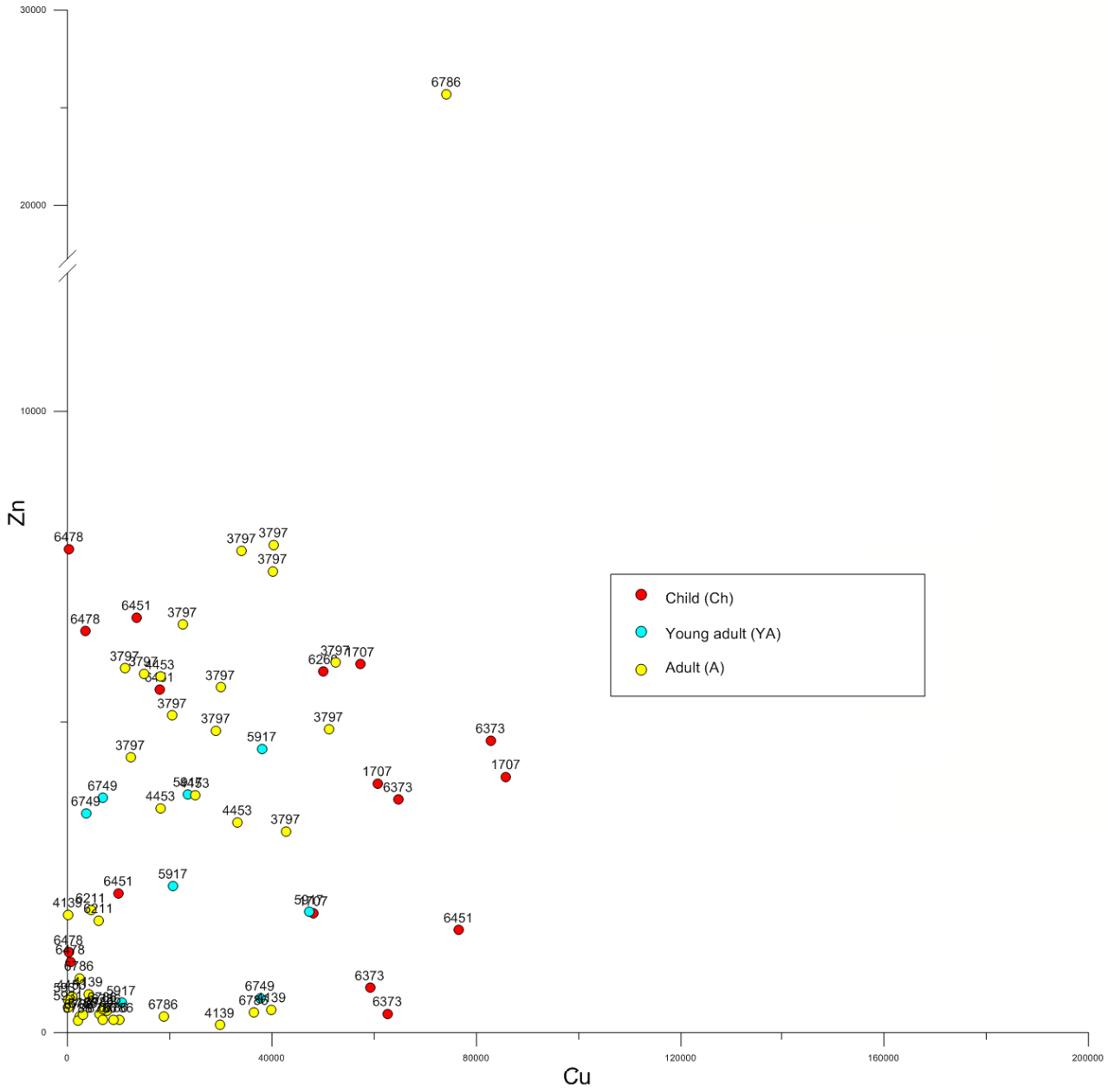

Figure 5.4: scatter plot of Cu/Zn ratios on the skull and postcranial bones (crown individuals); sorted/selected by age category.

Establishing the chemical criteria

One of the most important aspects of this chemical analysis was to research to what extend a funerary headdress can be identified based on a chemical analysis. The above discussed data illustrate that it is quite difficult to assume the presence of a funerary headdress with certainty solely based on chemical data; the chemical analysis should always be used in combination with other data/criteria. In addition, it should be noted that most of the chemical criteria were only based on data due to a small sample size of 'crown' individuals in this study.

Overall, the chemical data for the discolorations illustrate a wide variety in the Cu/Zn ratio; too much variety to identify certain objects (either identify specific brass objects or distinguish 'normal' objects from funerary headdresses) with any certainty or to establish criteria that can be applied on the other individuals under study. Combining the chemical data of the discolorations and the crown provided some insight into how the crown may be reflected in the discolorations. It was only possible for a few individuals to correlate the chemical composition of the crown with the chemical composition of the discoloration(s). For the remaining individuals, the decorations contained a lower Zn ratio than the discoloration(s); this may have been the result of selective leaching of Zn. A high amount of Ag (and/or Au) in combination with a high amount of Cu and a low(er) amount of Zn may possibly indicate a crown; but as various objects with a similar chemical composition as a crown may have been used, no definite conclusions should be made. Conclusively, the chemical data should always be used in combination with the previously established criteria for the other aspects of this burial custom.

Strong indicators & other finds

For the finds cirteria, the data for the individuals with a crown number were combined with historical and archaeological data on a funerary headdress. This allowed to specifically defining a few strong indicators of a funerary headdress, as well as establishing other finds – though in combination with other material - that may indicate the presence of a funerary headdress. The strong indicators and the other general indicators of a funerary headdress, and therefore the finds criteria, are presented in table 5.7.

Table 5.7: strong indicators and other indicators (decorations and residue) of a funerary headdress.

Strong indicators	Weak/other indicators	Only reliable in combination with...
Leonic wires/flowers, copper wire, iron wire, leaf-flower objects of metal, smaller/braided wires in general	Flowers (rosemary; roses)	One of the strong indicators OR copper/iron residue OR (green) discoloration(s) criteria OR a combination thereof
Glass (shreds/splinters)	Paper/textile/fabric (ribbon/flower-object)	One of the strong indicators OR copper/iron residue OR (green) discoloration(s) criteria OR a combination thereof
Copper/iron residue, in combination with organic residue	(green) Herbs, leaves	One of the strong indicators OR copper/iron residue OR (green) discoloration(s) criteria OR a combination thereof
	Beads (glass)/pearls or imitation pearls/sequins	One of the strong indicators
	Smaller metal wires (fringes)	One of the strong indicators

However, as some of these decorations are based on historical data, it should be noted that these finds may have a different appearance and/or will not always be present simultaneously (e.g. Leonic flowers not in the original shape or local variation in burial custom). In addition, the finds may be fragmentary or even absent from archaeological context due to preservation, especially organic finds. Therefore, even for the strong indicators, it is of importance to consider all of the inorganic and organic decorations in combination with the criteria for (green) discoloration(s) (see below).

Discolorations

Based on the discolorations of the crown individuals, criteria to indicate the presence of a funerary headdress were established. These criteria are based on location(s), shape, and size.

The areas most affected and probably correlated with the presence of a funerary headdress appear to be the frontal/orbits and /or the parietals. However, the area of the occipital should also be considered as an indication of the presence of a funerary headdress. Furthermore, regarding location(s), at least one of the previously discussed patterns in table 5.5 should be present, unless preservation limits a full analysis; meaning only a partial pattern is present. Both can indicate the presence of a funerary headdress. With no specific pattern present, there should be at least two correlating locations of green discoloration present. Size and shape of the discoloration is of importance; large, concentrated areas can indicate a funerary headdress, but large diffuse areas may also indicate a funerary headdress. These areas are often oval or round of shape.

In addition, the shape and size, as well as location, of the green discoloration on postcranial bones should also be considered. Again, large/diffuse areas of green discoloration on the hands or feet may indicate the presence of a funerary headdress; but these should be analysed in combination with green discoloration on the skull. As (green) discoloration(s) appear to be more frequently on the skull for the crown individuals, and both historical data and archaeological data indicate usage of funerary wreaths around the skull, the discolorations on the skull are more reliable as indicators of a funerary headdress than the discolorations on postcranial bones. However, both can be, unfortunately, difficult to differentiate between 'normal' copper alloy objects and a funerary headdress. In addition, it is difficult to determine the specific patterns and identify them as a diadem or a wreath. Assuming the presence of a funerary headdress using only discoloration is quite difficult with similar patterns (e.g. a wreath and a cap-like element) and possible lack of discolorations. Though this paragraph gave indications as to which type of green discoloration, as well as the amount and appearance of green discoloration may be associated with the presence of a funerary headdress, this is still quite difficult when applied on archaeological skeletal material. Therefore, to ensure the assumption of a funerary headdress is more reliable, the presence of certain decorations should also be taken into account.

Chemical data

As it was not possible to establish definite criteria for the chemical data, the results of any chemical analysis on the crown or discolorations possibly correlating with a crown must be used in combination with the aforementioned criteria. The presence of Ag and a high amount of Cu should be taken into account, but the discoloration(s) and finds criteria should be used to determine the presence or absence of a funerary headdress definitely.

Applying the criteria

Based on aforementioned data and the results as presented in the previous chapter, 5 distinctive groups could be observed. The individuals were categorized for each group solely based on discoloration(s) and finds; the chemical data was added later as this proved not to be a reliable criterion. Data such as sex and age were not a factor for categorizing an individual in a specific group; this study used the hypothesis that a funerary headdress can be present for any individual, regardless of age and/or sex. The first three groups contain all individuals with a (possible) funerary headdress, the last two groups contain all individuals with no funerary headdress.

Group 1) includes all the individuals for which no crown number was documented, but based on the criteria and the archaeologically expected material, were nevertheless possibly or probably buried with a funerary headdress. This group is presented first because of its importance to the research questions; it illustrates the possibilities of the criteria and the variation in archaeological visibility.
Group 2) includes some of the mentioned individuals in this paragraph; the individuals for which a crown number was documented, but finds and/or green discolorations were scarce.
Group 3) includes the rest of these 'crown' individuals; individuals for which a crown was documented and sufficient material to indicate the presence of a crown was documented. The crown individuals were categorized in these two groups to discuss the importance of visible archaeological evidence for a funerary headdress.
Group 4) includes the individuals not documented with a crown number, and based on the criteria were possible not buried with a funerary headdress.
Group 5) includes all the remaining individuals; these are the individuals which are very fragmented and were indeterminable.

The groups 1, 2, and 3 will be discussed in paragraph 5.1.2; groups 4 and 5 will be discussed in paragraph 5.1.3.

5.1.2 Individuals with (possible) crowns

This paragraph will discuss the individuals placed in group 1, 2, and 3. As mentioned, the first established group includes all the individuals for which no crown number was documented, although finds and discoloration(s) indicate the presence of a funerary headdress. Both group 2 (individuals with crown number but lack of discoloration/finds) and group 3 (individuals with crown number and sufficient discoloration/finds) will also be discussed in order to analyse the reliability of the indicators for the funerary headdresses.

5.1.2.1 Group 1: possible and probable funerary headdresses

As one of the indicators of a funerary headdress is the presence of a distinct pattern in the locations of green discoloration, the established patterns in paragraph 5.1.1.2 were used to select individuals for this group. This resulted in selecting 12 individuals for this group. These individuals are presented in table 5.8, highlighted in grey. However, some of these individuals were documented with a 'possible' pattern (i.e. green discoloration is not present on each location to indicate a specific pattern) but were still included in this selection, as a partial pattern could also indicate the presence of a funerary headdress.

Though the remaining individuals selected for group 1 were presented in the previous chapter with no specific pattern, the amount and location of green discoloration as well as certain finds were indicators of a possible funerary headdress. Of course, this was based on the established criteria for the finds and discoloration; these criteria were both used simultaneously, but also independently. Based on this, a total of 5 individuals were added to the aforementioned 12 individuals; this means group 1 consists of 17 individuals (table 5.8).

Table 5.8: overview of the individuals and the physical anthropological data in group 1. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	agecat	sex	age min	age max	AMstat (cm)	Pattern number (if present)
1024	A	M	54	60	170,6 ±3,27	1
1205	J	U	14	19		
1260	A	M	42,33	48,33	162,85 ±4,05	2
1377	A	F	51	60	155,12 ±3,72	3
1694	A	M	52	61	171,1 ±3,27	1
1695	A	F	20	26	151,17 ±3,72	2
1875	A	M	48	57	0	2
1887	A	F	61	66	159,7 ±3,55	2
1927	A	F	50	59	160 ±3,72	3
2009	J	U	12	16		1
2243	Ch	U	2	4		1
2278	Ch	U	6	10		
3087	A	M	20	25	167,55 ±3,27	1
3290	Ch	U	6	10		
3515	J	U	12	16		
4883	A	M	41	58	175,17 ±3,27	3
5830	J	U	13,5	16,5		

Observed patterns and possible crown types

Based on the observed patterns of green discolorations in 12 individuals, a few crown types, as previously mentioned, could be distinguished. Table 5.9 presents these individuals with their pattern number and the possible corresponding crown type discussed in paragraph 5.1.1.2.

Table 5.9: overview of the individuals in group 1 with a pattern and their corresponding crown type.

Find number	Pattern number	Crown type
1024	1	diadem
1694	1	diadem
2009	1	diadem
2243	1	diadem
3087	1	diadem
1260	2	Wreath: arch A
1695	2	Wreath: arch A
1875	2	Wreath: arch A
1887	2	Wreath: arch A
1377	3	Wreath: arch B
1927	3	Wreath: arch B
4883	3	Wreath: arch B

Diadem: pattern 1

A total of 5 individuals were documented with this pattern type, though there is variation between amount of discoloration(s), locations of discoloration(s), and finds. For the individual with find number 3087, the locations of green discolorations were limited and the preservation of the skeletal material was poor. This resulted that the appointed possible crown type for this individual was not conclusive. The additional chemical data only indicated that the discoloration on the sphenoid had a high amount of Cu; the other discolorations (also postcranial) fall in the brass group. However, this individual was also documented with small, thin, coloured glass fragments on the maxilla. This specific glass, according to the established criteria for finds, is a strong indicator for the presence of a funerary headdress. The presence of this glass combined with a only possible pattern in the green discoloration on the skull indicated that this individual was probably buried with a funerary headdress; the crown being possibly of the diadem-type.

Furthermore, a total of 4 other individuals were also documented with the pattern of a diadem, but were not documented with specific finds to directly indicate the presence of a funerary headdress. Therefore, only the criteria established for the discolorations could be used. For the individual with find number 1694 the areas of green discoloration on the left parietal and right sphenoid were, however, relatively small; but the combination with the large discolorations on the frontal did indicate that a diadem pattern was very likely. The iron residue between the orbits would suggest an iron object, instead of copper, was placed in this diadem. The smaller locations at both sides of the skull would also suggest the usage of smaller copper alloy objects for these areas; it may be possible these were pins to fasten an element of the crown and/or headgear. The chemical data corresponded with this; the Cu/Zn ratios suggested objects made of brass. The discolorations on the frontal had, however, a higher amount of Cu present and could therefore indicate the presence of decorative objects. Moreover, discoloration inside the left orbit indicated a high amount of Ag; this may be either from a coin or from a crown element. The presence of a coin was, based on a high amount of Ag, definitely established in the area of the mouth for this individual (discoloration present on the teeth).

The individual with find number 2243 had probably also a diadem-shaped crown; though the pattern was present, it was less pronounced as for the individual with find number 1694. In addition, the chemical data indicated also a Cu/Zn ratio of brass for all discolorations. Moreover, this individual was also documented with green discoloration on the posterior aspect of the mentum, which would correspond with the presence of a coin under the tongue. The chemical data for this discoloration indicated indeed a high amount of Ag; similar to the individual with find number 1694 this was probably also a coin placed in the mouth.

The green discoloration documented for the individual with find number 2009 indicated the probable usage of a diadem which apparently consisted of a large object of copper material on the forehead. Discoloration was also present on the left temporal, and though the right temporal was present, no discoloration was observed. The discoloration on the left temporal may, however, still correlate with the large area of green discoloration on the frontal and therefore indicating a diadem-shaped like crown. Unfortunately, no finds indicating a crown were documented to support the theory that this individual was buried with a funerary headdress. The location, shape, and amount of green discoloration did indicate the probable presence of a funerary headdress. In addition, the chemical data indicated that a high amount of Cu was present in the discoloration on the frontal; this may also point, in combination with the aforementioned data, to the presence of a funerary headdress.

Lastly, the individual with find number 1024 was documented with green discoloration above the left orbit and on the right frontal-sphenoid area. These locations were perhaps correlated;

they could indicate the presence of a straight object (with copper alloy elements) from the orbits to the side of the skull. Compared with the previously mentioned individuals, the presence of a pattern for the individual with find number 1024 was, however, uncertain. The measurements taken at these discolorations all indicated the presence of brass objects (no high Cu present). No finds were documented for this individual, so no other indicators of a possible funerary headdress were present; meaning it is possible this individual was buried with a funerary headdress but no definite conclusion can be made.

Wreath: arch A & B

For 7 individuals, an arch was probably present; a total of 4 individuals were documented with the arch type A, and three individuals with the arch type B. A distinct pattern could not be observed in all of these individuals; however the amount and location of green discoloration were suggestive of a partial pattern.

Wreath type A

The individuals with find number 1695, 1887, 1875, and 1260 had green discolorations corresponding with an arch which was probably located from shoulder to shoulder. All of these individuals had, though size and exact location varies, green discoloration on both sides of the skull (parietals/temporals) and on top of the skull; therefore possibly a wreath placed like an arch from shoulder to shoulder. The pattern observed in the individuals with find number 1887 and 1875 were very similar; these individuals had, in addition, also similar green discolorations on postcranial bones (discussed later). Only for the individual with find number 1260 the green discoloration is somewhat smaller and different than for the other mentioned individuals; it cannot be said with certainty that this individual was also buried with an arch type A. The smaller locations of green discoloration may suggest the usage of pins, but as to what type of headgear this corresponds with cannot be determined. It should be noted that the individual with find number 1695 was also documented with a fragment of glass and therefore indicating that a funerary headdress was very likely present. This fragment of glass is, however, somewhat different in appearance than the expected type of glass fragments for this burial custom as established in the criteria (e.g. the fragments documented for the individual with find number 6451). This same of type of glass was also documented for the individual with find number 3797; which was also documented with a crown number. Therefore, this may indicate that this type of glass can be brought into connection with this burial custom; however, it may also be possible for both individuals this glass was not part of this burial custom. The possibility that this fragment of glass was from a 'normal' object should not be excluded.

Analysing the results of the chemical data for the aforementioned individuals, all of the measurements taken at the discolorations indicate the presence of brass objects; in addition no

specific variation in the Cu/Zn ratio is present amongst these discolorations. Even so, the presence of a funerary headdress may be still possible based on the discolorations and finds.

Wreath type B

The arch type B was documented for three individuals. It should be noted that for two of these individuals, find numbers 1377 and 1927, all of the green discolorations documented on the skull were relatively small. The green discoloration on the occipital of the individual with find number 1927 can therefore indicate a small, round object, such as a coin. The chemical data did, however, suggest that an object of brass was probably present as no high amount of Ag was measured. The green discoloration documented on both parietals for this individual was located posteriorly on the sagittal suture (near the occipital) and was larger. These locations can be the remnants of an arch placed on the back of the skull, though there appears to be a lack of green discoloration on the parietals.

For the individual with find number 1377, the area of green discoloration on the occipital was larger than for the individuals with find number 1927. In addition, the area of green discoloration on the right temporal of this individual was also relatively large. It was therefore more probable this individual (find number 1377) was buried with an arch type B than the individual with find number 1927; however no definite conclusions can be made.

The green discoloration documented for the individual with find number 4883 was present on the occipital, the right parietal, and inferiorly on the sphenoid. Though both locations of the occipital and the right parietal suggested a pattern similar as for the previously described individuals, a definite conclusion regarding the presence of this pattern cannot be made. The green discoloration on the parietal was relatively large; the green discoloration on the occipital was relatively small. The green discoloration on the sphenoid, which was located near the teeth, may also suggest the presence of a coin. This was confirmed based on the chemical data; a high amount of Ag was measured in this discoloration. Therefore, a coin was probably present in the area of the mouth, similar to the individuals with find number 1694 and 2243. Again, for these individuals the chemical data indicated that the green discolorations were the result of brass objects; this does not mean that no funerary headdress was present for these individuals.

Other individuals: no pattern

As presented in table 5.8, a total of 5 individuals were also included in group 1, but were not documented with a specific pattern in the green discoloration. The locations and amount of green discoloration, as well as certain finds documented with these individuals, did meet the criteria.

This was especially true for the individual with find number 5830. As reported in the previous chapter, on multiple locations on this individual (skull and postcranial) fragments of glass were documented. The appearance of this glass (small, thin, coloured) corresponded with the strong indicator of reflective material, and therefore the presence of a funerary headdress was very likely. Moreover, organic residues in combination with copper residue/discoloration(s) were documented on both the ilium and the upper limbs. The appearance of this organic material, which appears to be a decorative oval-shaped element, resembles the aforementioned decorations frequently used in funerary headdresses. These inorganic and organic residues were present on postcranial locations (upper limbs and pelvic); which can also be associated with the presence of a funerary headdress. Furthermore, copper residue (fragments as well as the copper ring) indicated usage of decorative copper elements. This all strongly supports the theory, based on finds, that a funerary headdress was present for this individual. The green discoloration for this individual was, however, very limited on the skull. The only documented green discoloration is present on the right parietal-occipital and the right zygomatic. The rest of the skull was fragmentary but no other skull fragments were documented with green discoloration. The green discoloration on the right parietal-occipital was a large area, meaning possibly a large copper alloy object was present. The green discoloration on the zygomatic may also be from a crown element, though it was not possible to reconstruct a pattern. The green discolorations on postcranial bones suggest elements of copper (alloy) were present on the thorax (green discoloration on the ribs), on the wrist (carpals), and around the pelvis (as mentioned). Though no definite objects could be determined, these copper elements may have been decorative elements in relation to the funerary headdress; possibly elements of a wreath present on the postcranial regions. According to the chemical data, the majority of the discolorations fall in the brass ratio; the only discoloration containing a (very) high amount of Cu was on the posterior aspect of the ilium.

For the remaining 4 individuals, find numbers 1205, 2278, 3290, and 3515, the documented discolorations as well as the finds were not as convincing as for the previously described individual. All of the documented discolorations were, based on the chemical data, from brass objects. Though these individuals did not always fully meet the criteria, some of the discolorations and finds did indicate a possibility that a funerary headdress was present. A fragment of glass was documented for the individual with find number 3290, which would

indicate the presence of a funerary headdress. The type of glass documented was similar in appearance as the fragment of glass documented for the individual with find number 1695 (large, thick glass) and crown individual 3797; again no definite conclusions could be made. For the remaining 4 individuals, the documented relatively large areas of green discoloration did meet the criteria for the discolorations and based on these data, these individuals were included in group 1 but categorized with a 'possible' funerary headdress as no other indicators werepresent. Additionally, the individual with find number 3515 was also documented with green discoloration on the teeth; the chemical data indicated a high amount Ag present. It may be very likely a coin was present in the mouth; similar to the individuals with find number 1694, 2243, and 4883.

Patterns/locations of discoloration on postcranial bones

Though the focus of this study is mostly on the (green) discoloration(s) on the skull, data from the crown individuals indicated that (green) discoloration(s) on postcranial bones can be remnants of a garland/wreath and should therefore be considered. The green discolorations on postcranial locations have already been discussed for the individual with find number 5830; of which it is very likely a funerary headdress was present. However, for a selection of individuals from group 1 some locations of green discoloration were also documented on postcranial bones. The most frequent occurring location was the pelvic area (n=5); of which two individuals did not have a specific pattern of green discoloration on the skull (individuals with find number 1205 and 3515). For three individuals (find number 1205, 2009, and 3515) the green discoloration was a relatively large area; suggesting that possible a decorative element of a wreath was present. However, the chemical data for these measurements indicate that brass objects were present. Whether a decorative brass object of a wreath or, for example, a rosary was present, cannot be determined. The other two individuals (find number 3087, pattern 1, and 4883, pattern 3) had both areas of green discoloration which were smaller. Unfortunately, no specific objects could be determined based on the chemical data; again it may be possible either an element of a wreath/crown or a rosary, if not a pin or buckle, was present.

For the individuals documented with a (possible) diadem (pattern type 1, n=5) there are more differences among the locations of green discoloration on postcranial bones. Green discoloration in the pelvic area occurs (the aforementioned individuals with find number 2009 and 3087) as well as much smaller and fewer locations of green discoloration (individuals with find number 1024 and 2243). The locations and appearance of the latter green discolorations suggest the usage of pins rather than decorative objects; the chemical data indicated the presence of brass objects, though the Cu/Zn values measured for the individual with find number 2243 were higher than for other individuals. Again, it was not possible to determine the type of object with certainty.

The individual with find number 1694, also with a pattern indicating a diadem, was however documented with many locations of green discoloration on postcranial bones. Green discoloration was documented on the hands; the presence on the metacarpals (palm/back of the hand) suggested that no rings were present. It can, however, suggest the presence of a copper alloy object around the wrist(s) or on/in the hand(s). Furthermore, for this individual green discoloration was also documented on the right shoulder joint and the left first rib; these were smaller areas of discolorations. The green discoloration on the right femur/acetabulum and the right tibia (proximal and distal, posterior surface) were also only small areas. These small areas may suggest the presence of pins or buttons; the chemical data indicated probably brass objects. The discolorations on the hands had, however, a higher amount of Cu present. Again, it may be possible this was from a bracelet or from a decorative element of a wreath.

Some individuals with a documented pattern of wreath type A had also remarkable green discoloration on postcranial locations. The individuals with find number 1875 and 1887, both documented with the wreath type A (pattern 2), were also both documented with green discoloration on the manubrium. Both locations of discoloration on the manubrium were anteriorly, and on the right side. However, the individual with find number 1875 was also documented with green discoloration on some of the ribs, which can be correlated to the discoloration on the manubrium. The chemical data corresponded with this, as all of the measurements taken in this region for these individuals had similar values; possibly a similar object was present for both individuals. The other individual documented with this pattern, find number 1695, did not have green discoloration on the same locations for postcranial bones. For this individual, the green discoloration on the first ribs and proximal part of the right ulna indicated brass objects were present.

One individual with wreath type B, the individual with find number 4883, was documented with green discoloration on both shoulder joints, the right ribs, in the pelvic area, and on the shaft of the right femur. These discolorations are relatively small and may indicate the usages of pins or eyelets/wires in these areas. All of the chemical data for this individual indicated brass objects; no specific Cu/Zn ratio could be observed for certain postcranial regions. However, for the discolorations on the right scapula a high amount of Ag was measured. As no high amount of Cu was present, it was difficult to determine the type of object; it was possible this was either a decorative element or a functional object coated with silver.

Discoloration on postcranial bones was also present for one individual documented with no specific pattern in the green discoloration on the skull; find number 3290. For this individual, this was located on the proximal right humerus, which was a relatively large area. Discoloration on postcranial bones of the other individuals documented with no specific pattern in the green

discoloration on the skull were already discussed (the individuals with find number 5830, 1205 and 3515); find number 2278 was not documented with discolorations on postcranial bones.

Overview: the 'probable' and 'possible' funerary headdresses

Based on the discussed data and observations, it was possible to distinguish between the individuals with a 'probable' and 'possible' presence of a funerary headdress. For each observed pattern, there were individuals with a 'probable' funerary headdress, but also a 'possible' crown; this because not each observed pattern was conclusive. Based solely on finds and discolorations, it appears that for two individuals it was very highly likely they were buried with a funerary headdress; the individuals with find number 3087 and 5830. In table 5.10 all of the discussed individuals in this group are presented; ordered by probability on the presence of a funerary headdress.

Table 5.10: overview of the individuals with physical anthropological data in group 1; ordered by probability on the presence of a funerary headdress. Green= very probable, light-green= probable, very light-green= possible. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	agecat	sex	age min	age max	AMstat (cm)	Pattern number (if present)
5830	J	U	13,5	16,5		
3087	A	M	20	25	167,55 ±3,27	1
1695	A	F	20	26	151,17 ±3,72	2
1694	A	M	52	61	171,1 ±3,27	1
1875	A	M	48	57	0	2
1887	A	F	61	66	159,7 ±3,55	2
2009	J	U	12	16		1
2243	Ch	U	2	4		1
1205	J	U	14	19		
2278	Ch	U	6	10		
3290	Ch	U	6	10		
3515	J	U	12	16		
4883	A	M	41	58	175,17 ±3,27	3
1377	A	F	51	60	155,12 ±3,72	3
1927	A	F	50	59	160 ±3,72	3
1260	A	M	42,33	48,33	162,85 ±4,05	2
1024	A	M	54	60	170,6 ±3,27	1

Table 5.10 illustrates that the presence of a specific pattern did not always indicate the presence of a funerary headdress. The last 5 individuals displayed in table 5.10 were all documented with a type of pattern, but the amount of green discoloration as well as the (lack of) finds documented and the location of this green discoloration were not indicative of a funerary headdress. These individuals were therefore placed in the category of a 'possible' funerary headdress, but no definite conclusions can be made. Also, the lack of a specific pattern present on the skull does not indicate that a funerary headdress was absent. The individuals with find number 1205, 2278, 3290, and 3515 illustrated that the amount of green discoloration, though not in a specific pattern, sometimes in combination with the documented finds, can indicate the presence of a funerary headdress.

5.1.2.2 Group 2: Individuals with crown number, insufficient finds

The crown individuals were already discussed partially for establishing the criteria, but all data regarding these individuals will be here discussed. Group 2 consists of the individuals presented in table 5.11. These individuals were categorized in this group based on lack of discoloration(s), finds, or other aspects which did not correspond directly with the presence of a funerary headdress; even though these were documented with a crown number.

Table 5.11: overview of the individuals and the physical anthropological data in group 2. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	krn_nr	agecat	sex	age min	age max	AMstat (cm)
6260	6361	Ch	U	0	1	0
6476	6470	Ch	U	0,5	2,5	0
6478	6479	Ch	U	3	5	0
6211	6271	Ch	U	7,5	12,5	0
6589	6591	A	U	21	???	0
6749	6748	A	F	25	30	155,41 ±4,24
5931	5919	A	F	37,33	43,33	178,93 ±4,45
4139	4139	A	M	50	65	178,86 ±4,05

While discussing the data from the crown individuals in paragraph 5.1.1, it became clear that the data for these individuals were not sufficient enough to establish any of the criteria. Additionally, applying the discoloration(s) and to some extend the find(s) criteria on these individuals would result in determining that no funerary headdress was present. For example, the individuals with find number 6476 and 6589 were documented with no discolorations, and both of these individuals were very poorly preserved. For the individual with find number 6589 copper wire was documented (thick, braided), but no specific finds for the individual with find number 6476 were documented. The remaining individuals had discoloration(s) on scare locations, all of which indicated no specific pattern or partial pattern. Even though based on the excavation documentation a crown was definitely present for these individuals, the archaeological visibility of the funerary headdresses was poor. This was in contrast for the other crown individuals (group 3, discussed below), and comparing these data may allow researching which aspect(s) influence(s) the archaeological visibility.

The individual with find number 4139 was documented with only one area of green discoloration. A fragment of wire was also documented for this individual; this was a much thicker wire fragment than present for the other individuals. This fragment appears to be also coated with silver, corresponding with the known data on Leonic wires; the object itself was unfortunately indeterminable (Nooijen, 2016, p.142). Even though this find indicates the presence of a funerary headdress, the amount of green discoloration is scarce, and in addition the location of this green discoloration is not expected (zygomatic).

In addition, two individuals documented with quite distinctive crown elements were also placed in this group; however, the absence of other important aspects indicated this burial custom was poorly represented. Placing these individuals in this group instead of group 3 (see paragraph 5.1.2.3) may also allow researching which aspect(s) influence(s) the archaeological visibility of this burial custom. The individual with find number 6478 was documented with copper wire resembling a flower, as previously discussed. However, this is the only indicator for a funerary headdress, as this individual was further only documented with blue residue. Though such a decoration is a strong indicative of a funerary headdress, the lack of any discoloration(s) as well as the lack of chemical correlation between the object and the individual resulted in placing this individual in group 2.

Moreover, the individual with find number 5931 also illustrates the difficulty in identifying a funerary headdress due to the presence and absence of different aspects. The last individual in this group is the exception in the state of preservation; the individual with find number 5931 was well preserved and the majority of skeletal regions were represented. This individual was only documented with blue residue (diffuse) on the skull. However, the chemical data had indicated that the presence of blue residue cannot be with certainty associated to the presence of a funerary headdress. The finds documented for these individual consisted of copper wire (entwined and braided); no distinct shape could, however, be recognized. Based on the construction it was likely these were Leonic flowers. However, the lack of green discoloration(s) and lack of chemical correlation between the blue discoloration and the decorations indicated that the presence of a funerary headdress cannot always be completely visible.

5.1.2.3 Group 3: Individuals with crown number, sufficient finds

The crown individuals with sufficient data to identify a funerary headdress were categorized in this group (table 5.12). Each individual was of course already discussed in the criteria paragraphs, but the obvious difference(s) in the archaeological visibility compared to the previous group were not discussed.

Table 5.12: overview of the individuals and the physical anthropological data in group 3. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	krn_nr	agecat	sex	age min	age max	AMstat (cm)
6373	6392	Ch	U	1	2,8	0
1707	1707	Ch	U	1,3	2,6	0
6451	6453	Ch	U	5	9	0
5917	5918	J	U	18	24	0
3797	3791	A	U (F based on DNA)	21	??	0
6786	6787	A	F	30	60	0
4453	5355	A	F	40	80	0

In the criteria paragraphs, it was noted that the young(er) individuals were more frequently documented with no or scarce discoloration. It was suggested that this may be the result of poor preservation, as well as the difficulty of determining skeletal elements of young individuals - and possibly fragmentation as well. However, after categorizing all of the crown individuals in these two groups, it became clear that both groups had an equal amount of young individuals present (n=4 for group 2; n=3 for group 3). Additionally, the preservation of the skeletal material was poor for individuals from both groups (i.e. fragmentary and absent skeletal regions). This would mean that preservation and fragmentation of a young individual did not influence the archaeological visibility of a funerary headdress.

It can be discussed that there might have been differences in the construction and decoration of the crowns; with no definite data on what may have been present in these crowns this was difficult to establish. However, the chemical data for all of the crowns (group 2 and group 3) indicated no differences in the amount of Cu or Ag present; meaning a similar chemical composition. The only observable difference was the lower amount of Zn in group 2; but as already discussed for the chemical criteria, the amount of Zn was generally lower in the analysed crowns. Though the cause of these differences in the archaeological visibility of a funerary headdress between these two groups was unclear, it did illustrate the possible variation that may be present in the archaeological context. Moreoover, it illustrated the

'invsible' funerary headdresses, which may be the result of construction/decoration (i.e. only organic material) and/or taphonomical processes. Even though the criteria were established to identify a funerary headdress, if these aspects are present a funerary headdress may remain 'invisible' in archaeological context.

5.1.3 Individuals with no funerary headdresses

The remaining individuals under study were probably buried without a funerary headdress; this based on the established criteria. These individuals were divided up in two different groups. One group, group 4, includes all the individuals which could be (fully) analysed. The second group, group 5, includes all the individuals which could not be fully analysed due to preservation and fragmentation. For this last group the poor preservation and fragmentation resulted in no definite conclusions regarding the presence or absence of funerary headdresses.

5.1.3.1 Group 4: no crown present

Even without the established criteria, it was possible to determine that for a few individuals definitely no funerary headdress was present. However, using the criteria, additional individuals were selected for group 4 (n=15).

The individual with find number 3426, as previously described in paragraph 4.2.8, was documented as the only individual with no green discoloration and no finds. Assuming that the presence of a funerary headdress is not without any remnants (e.g. green discoloration), it can be concluded that this individual was not buried with a funerary headdress. Individuals which were documented with only one location of green discoloration were, according to the criteria, probably not buried with a funerary headdress. These individuals are presented in table 5.13. For these individuals no specific pattern could be observed, and the amount and shape of green discoloration indicated that probably no funerary headdress was present. Furthermore, no finds were documented for these individuals. The chemical data did not aid; most measurements indicated brass objects. Only for the individual with find number 1773 did the chemical data indicate the presence of silver (Ag) on the right zygomatic; probably the presence of a coin.

Table 5.13: individuals in group 4 documented with only one location of green discoloration.

Find number	Type residue	Location/Skeletal element	Finds?
1333	Green	Top of skull, large area	No
1773	Green	Right zygomatic, small area	No
1796	Green	Forehead, large area	No
3974	green	L temporal-occipital, small area	No

However, for some individuals multiple locations with green discoloration on the skull were documented (n=3); see table 5.14. Though the presence of multiple locations of discoloration is an indicator for the presence of a funerary headdress, these locations of discoloration as well as the appearance of the discolorations did not meet the established criteria. It was also not

possible to observe a partial or full pattern in the locations of these discolorations. Furthermore, for none of these individuals green discoloration was documented on any postcranial bones; nor were any finds documented. Even so, the green discolorations documented for the individual with find number 1835 were located in a straight line from the anterior towards the posterior side of the skull; indicating some pattern. However, both the appearance of the discolorations (small, not well visible) and the chemical data (low amount of Cu and Zn) indicated that these discolorations were probably not correlated. The discoloration on the foramen magnum of this individual was also very small and could possibly indicate the presence of a coin; the results of the chemical analysis contradicted this as no Ag was measured.

Table 5.14: individuals in group 4 documented with only multiple locations of green discoloration.

Find number	Type residue	Location/Skeletal element	Finds?
912	Green	Left mandible, left orbit, both small areas	No
1100	Green	Right maxilla, left temporal, both very small areas	No
1835	Green	Sagittal suture (large), right parietal, foramen magnum	No

In table 5.15, the individuals are presented which were documented with multiple locations of green discoloration on the skull, but also with discoloration on postcranial bones. These multiple discolorations on the skull, though it may indicate the presence of a funerary headdress, were again not present in any type of pattern. Most of the locations were relatively small, which also meant that these areas of green discoloration did not meet the requirements to indicate the presence of a funerary headdress. Additionally, taken both the discolorations on the skull and the postcranial bones into account, no specific pattern could be observed.

Table 5.15: individuals in group 4 documented with multiple locations of green discoloration, both on the skull and on postcranial regions.

Find number	Type residue	Location/Skeletal element	Finds?
899	Green	Right orbit/maxilla, large area, left ulna, L5	No
1831	Green	4th prox. phalange, right occipital, right radius, all small areas	No
2366	Green	Left temporal, left tarsal, both small areas	No
2403	Green	Mandible, small area, C7-T1, L2-L5	No
4889	Green	Left parietal, right shoulder joint, rib, all small areas	Yes
6205.1	Green	Left ulna, left radius, right and left tibiae, right femur, all small areas	No
6205.2	Green	Spine and thorax, small areas	No
6205.2	Iron	Left tibia, small areas	No

Furthermore, for all individuals in table 5.15 but the individual with find number 4889, no finds were documented. The find documented for this individual was a fragment of glass documented for the body region of the thorax. The glass fragment was similar to glass fragments for the individuals with find number 1695, 3290, and 3797. As previously explained, it cannot be definitely concluded whether or not this type of glass could have been used in combination with a funerary headdress. However, as this individual was documented with only one location of green discoloration on the skull, the presence of a funerary headdress was uncertain.

Based on location and size, it may be possible these discolorations were the remnants of functional objects (e.g. pins, buttons). The chemical data for these individuals all indicated that brass objects were probably present, though some measurements indicated a relatively high amount of Cu and a lower amount of Zn (individual with find number 2366; tarsal). These latter measurements may indicate the presence of jewellery, as the presence of decorations from a funerary headdress is not likely for these individuals based on the lack of strong indicators.

Remarkably, the discoloration on the posterior aspect of the mentum documented for the individual with find number 2403 may indicate the presence of a coin under the tongue – also documented for some individuals in group 1. The chemical data definitely concluded the presence of a coin; a high amount of Ag was measured in this discoloration. The discoloration on the left parietal documented for the individual with find number 2366 also contained a high amount of Ag; the small area may indicate the presence of jewellery.

The presence (or absence) of a funerary headdress was also difficult to establish with certainty for the individuals with find number 6205. As this find number probably consists of two individuals, the green discoloration documented for the postcranial bones could not be correlated at all with the skull. Even though the green discoloration was not substantial for both individuals, it was concluded that due to the fact that multiple individuals are present, the presence of a funerary headdress could not be established with certainty.

Table 5.16 presents the previously discussed individuals with the physical anthropological data.

Table 5.16: overview of the individuals and the physical anthropological data in group 4. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	agecat	sex	age min	age max	AMstat (cm)
899	A	M	43,75	55,25	171,3 ±3,27
912	A	F	25	34	157,84 ±3,72
1100	A	F	36,33	42,33	164,4 ±4,24
1333	A	F	51,67	57,67	157,17 ±3,55
1773	J	U	14	16	0
1796	A	F	52	61	0
1831	A	M	44	50	170 ±3,27
1835	A	M	33,33	39,33	164,62 ±2,99
2366	A	F	37	46	167,72 ±3,72
2403	A	F	20	30	167,48 ±3,51
3426	A	M	46,5	51,5	183,02 ±3,27
3974	A	F	37,33	43,33	165,5 ±4,45
4889	A	M	41	58	171,47 ±4,05
6205.1	A	F	25	43	0
6205.2	A	M	0	0	0

5.1.3.2 Group 5: insufficient data

For a selection of individuals it was impossible to determine the presence or even the absence of a funerary headdress; these individuals (n=2) were placed in the last group. Both these individuals were poorly preserved and very fragmented. This resulted in less data from the physical anthropological analysis, and it was therefore difficult to establish either the presence or absence of a funerary headdress. For the individuals with find number 2611 and 4891 green discoloration was documented for determinable skull fragments (respectively the frontal and the mandible), but no other locations with green discoloration were documented and therefore the presence of a funerary headdress could not be established. However, based on the chemical data, the green discoloration documented for the individual with find number 2611 consisted mostly of Cu. The discoloration on the mandible of the individual with find number 4891 also consisted of a high amount of silver (Ag), which indicates the presence of a coin in the area of the mouth. Table 5.17 provides an overview of the aforementioned individuals in this group.

Table 5.17: overview of the individuals and the physical anthropological data in group 5. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

vnr	agecat	sex	age min	age max	AMstat (cm)
2611	Ch	U	7	11	0
4891	A	U	>21	0	0

5.2 Discussion funerary headdresses in Oldenzaal

With the established (probable) presence and (probable) absence of a funerary headdress in the individuals under study, this paragraph will compare these data with additional data (i.e. sex estimation, age estimation, time period, location of the grave). Comparing these data will allow to research possible differences in the presence or absence of a funerary headdress. Furthermore, the archaeological visibility of a funerary headdress, which affects the possibility to assume that a funerary headdress was present, will be discussed. This will be done based on data from this study (e.g. preservation of specific materials), but also based on data from previous archaeological examples combined with historical data (data from chapter 2). Finally, the findings of this study will be compared with the previous archaeological examples to research local variation and similarities in this burial custom.

5.2.1 Interpretation results: sex/age/time period

In the following paragraphs, data on presence/absence of a funerary headdress will be compared with data on time period, location of grave, physical anthropological data, and the chemical data. In doing so, this may indicate for example the usage of this burial custom in a specific period for Oldenzaal (time period/location grave). Furthermore, the biological profile of the individuals under study, as established by the physical anthropological analysis, combined with data on presence/absence of the funerary headdresses, may indicate usage of this burial custom for specific individuals. This allows researching if the funerary headdresses were indeed a burial custom which was 'for everyone', regardless of sex and age. In the last paragraph, all of the chemical data will be discussed; this to analyse the possibilities to distinguish specific Cu/Zn ratios or other elements for individuals with or without a funerary headdress.

5.2.1.1 Time period & location grave

Comparing the data on time period with the presence/absence of a funerary headdress was difficult. Most of the individuals under study were not sampled to conduct radiocarbon dating of the grave. In addition, the small selection of individuals which were sampled, radiocarbon results indicate a date later than AD 1500. Based on historical data on the usage of the funerary headdresses, it would be expected the graves should be at least older than AD 1700. However, archaeological data from the Netherlands indicate usage of this burial custom in the period of AD 1800-1900. As presented in the first chapter, the cemetery of the Plechelmus church was not in use after 1829. This would imply that the individuals under study derive from the period 1500-1829. It should be noted that, however, in the period of 1633-1810 the church was taken over by the Protestant Reformation (as also presented in the first chapter). It may be that during this period of time, a burial custom such as the funerary headdresses could not be conducted fully.

As already mentioned in the background chapter, there was an attempt to forbid this burial custom in 1656 (Hirsch, 1921; Kok, 1990) and a general decrease of this burial custom was observed in the 17th century. This is, however, not true for all regions; Portegies (1999) mentions an overall usage of this burial custom throughout the 17th century until the 19th century. In addition, Lippok (2011) reports for Germany also no decrease or difference(s) in burial custom during this time period. However, according to Kok (1990)), the general decrease and attempt to forbid this burial custom in certain regions did allow for alternative ways to conduct this ritual; Kok (1990, p.158) describes alternative decorations such as stars and crosses on shrouds. If such was the case during the overtake of the Protestant Reformation in Oldenzaal as well, this would mean that the presence of funerary headdresses were decreased or invisible (depending on how and if the burial custom was still conducted) during this time period. This may explain the less 'visible' funerary headdresses documented in this study; however, with no specific dating on each individual it is impossible to determine this with certainty. Furthermore, this would imply that the 'visible' funerary headdresses were either from the time period of 1500-1633 or 1810-1829. The latter is quite a small period of time; the first would indicate that this burial custom was conducted very early when compared with the majority of historical sources and archaeological examples. However, comparing other archaeological examples of funerary headdresses from the same time period (i.e. Den Bosch, Didam, and Haarlem) indicate no decrease or variation in the burial custom, though these churches were also taken over by the Protestant Reformation around the same time. It is therefore not completely clear if this burial custom was continued, conducted differently or completely absent in this time period; an interesting aspect for further research.

The location of the graves in the graveyard combined with the data on the presence/absence of a funerary headdress was less difficult to analyse. Though the representation of different periods/phases was each zone was difficult, it did illustrate the distribution of graves with/without a funerary headdress. Figure 5.5 illustrates the graves under study; the green graves are the individuals from group 1, 2, and 3 (with funerary headdresses) and the red graves are the individuals from group 4 and 5 (no funerary headdresses present). There appears, however, to be no cluster present of individuals with or without a funerary headdress in a specific region of the graveyard.

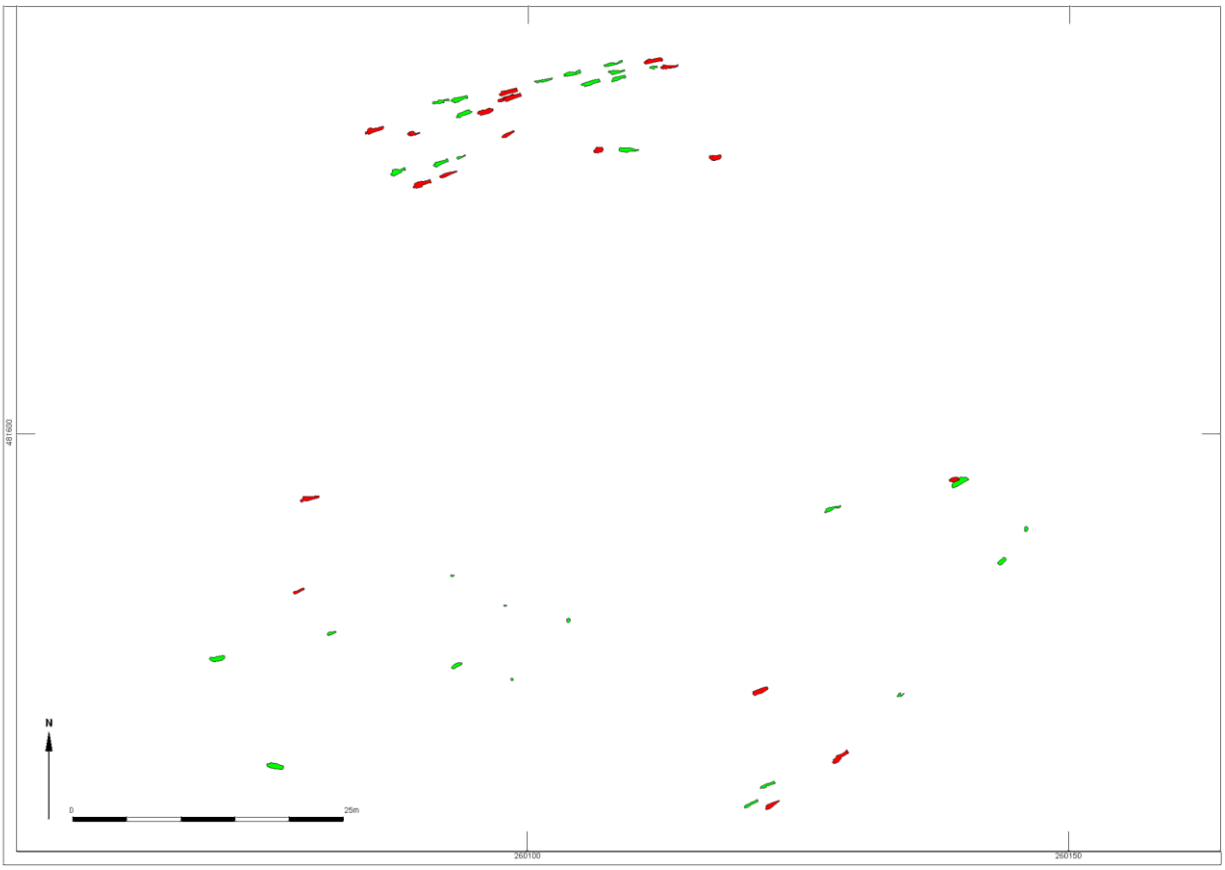

Figure 5.5: location of the graves under study. Green= graves from group 1, 2, and 3 (with a funerary headdress), red= graves from group 4 and 5 (with no funerary headdress).

Remarkably, when the individuals from group 1 are 'excluded', and only the crown individuals are displayed (group 2 and 3), a specific clustering of individuals with a funerary headdress is visible (fig. 5.6). It appears that the majority of the individuals from group 2 and group 3 were present in the south region of the graveyard. There is one crown individual, find number 1707, which was present in the north region of the graveyard. In addition, more individuals are located in the south-west region than in the south-east region of the graveyard (n=7 and n=4 respectively). It may be very well possible this graveyard was later in use, as the expected time period for this burial custom is 1600-1900.

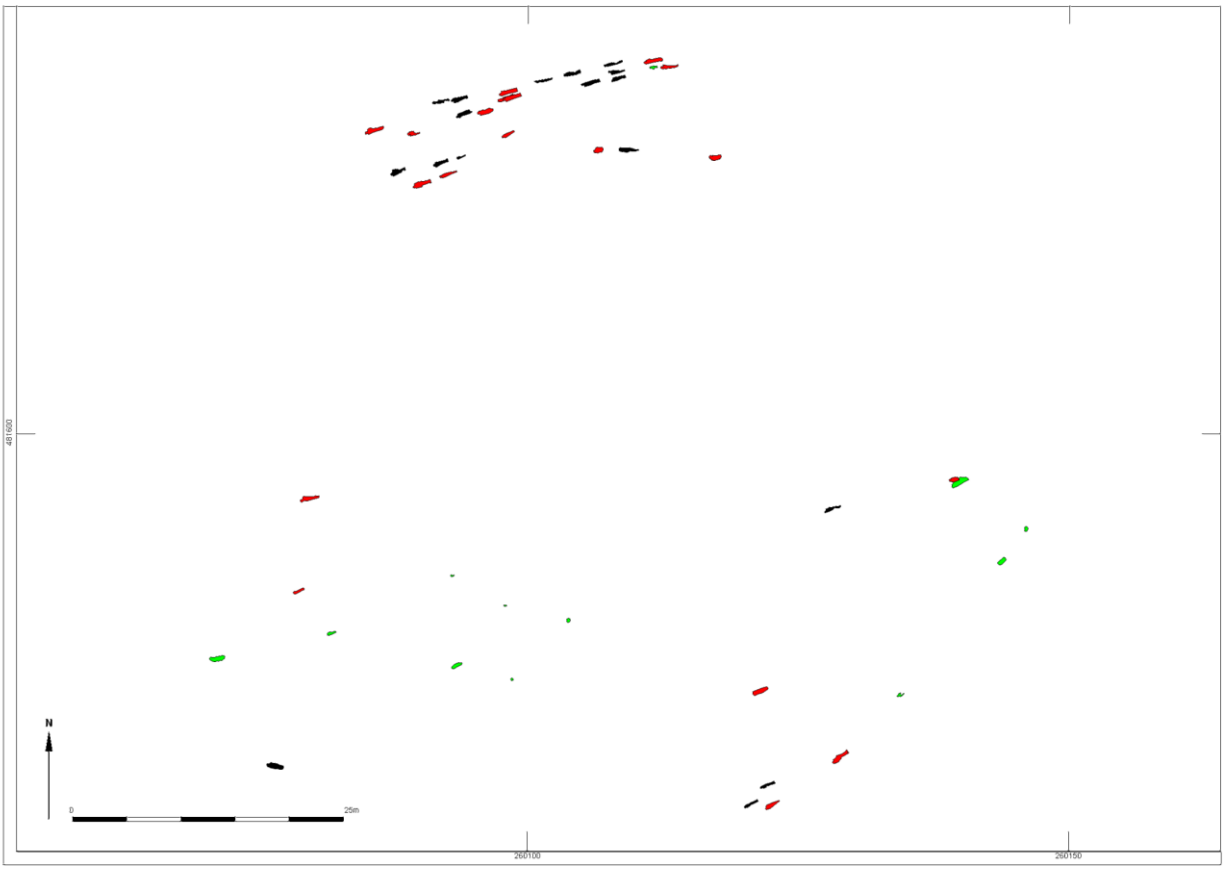

Figure 5.6: location of the graves under study. Black= graves from group 1 (excluded), green= graves from group 2 and 3 (with a funerary headdress), red= graves from group 4 and 5 (with no funerary headdress).

5.2.1.2 Age estimation and funerary headdresses

Though the hypothesis used in this study is that everyone can be buried with a crown, historical sources do point to a more frequent use of this burial customs for children, and especially for very young children. This would mean that more young individuals should be included in the groups where the presence of a maiden was established than in the groups in which no funerary headdress was observed. Therefore, more young individuals should be included in group 1 (n=17), group 2 (n=8), and group 3 (n=7), when compared with group 4 (n=15). Group 5 (n=2) is excluded for this comparison, as the presence of a funerary headdress for these individuals cannot be analysed and therefore not be established. Comparing group 1 and group 4, of which the total number of individuals included were similar, it seems that there were indeed more young individuals and young adults in the group where the presence of a funerary headdress was established than in the group where no funerary headdress was observed (n=9 in group 1 and n=3 in group 4). The total number of individuals in group 2 and 3 was less, so a comparison with group 4 was difficult (small sample size). Even so, the majority of individuals in both group 2 and group 3 were young individuals and young adults (n=5 in group 2 and n=4 in group 3). The various age categories (Ch= child, J= juvenile, and YA= young adult) represented in all these groups are displayed in figure 5.7a, 5.7b, and 5.7c. Though the individuals of group 5 were not included in the comparison, they were added in these figures to distribute the number of individuals evenly.

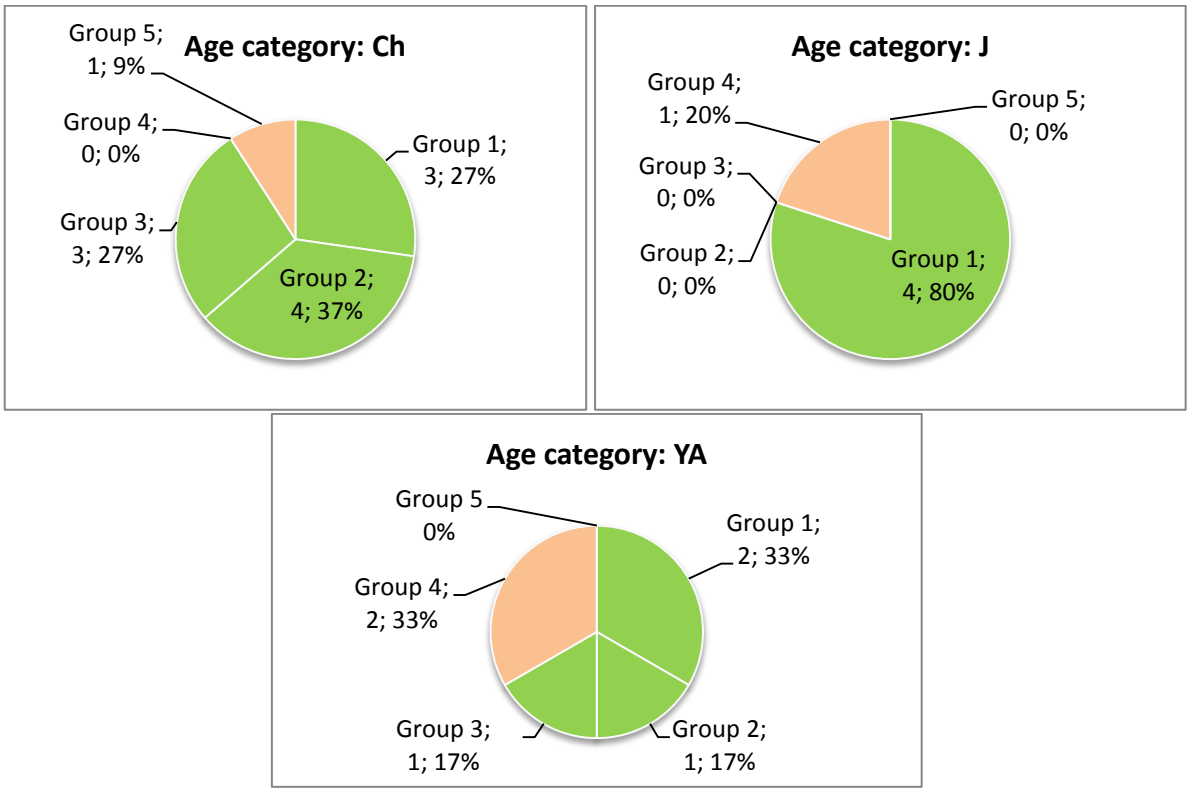

Figure 5.7a, b, and c: distribution of the younger age categories between the established groups. Up-left (a): age category child (Ch); 100% = 11 individuals. Up-right (b): age category juvenile (J); 100% = 5 individuals. Down (c): age category young adult (YA) 100% = 6 individuals. Total number of young individuals for all groups = 22.

Based on these data, it appears that the majority of all young individuals (all three aforementioned age categories) were either in group 1, 2, or 3. Group 4 consists mostly of adults (n=12); though one juvenile and two young adult individuals were included in this group. With this specific age distribution between these groups, it would seem that this burial custom was indeed present more often with (very) young individuals.

As mentioned, the majority of adult individuals were in group 4 (fig. 5.8), though a selection of adult individuals were also documented with a (probable) funerary headdress and were placed in the other groups (n=8 for group 1, n=3 for group 2, and n=3 for group 3). For group 1, the number of adult individuals compared to the number of young individuals is similar; this is the same for the individuals in group 3 (fig. 5.9). This evenly distributed number of adult and young individuals in group 1 and 3 suggests, however, that there is no difference between the age of the individual and the presence of a funerary headdress. This of course contradicts the previously established conclusion regarding age and the presence of a funerary headdress; it may be possible that though frequently young(er) individuals were buried with a funerary headdress, there is not always an age difference present in this burial custom.

As for age differences between the adults, the age estimations for the adults were generally rather broad, which makes it difficult to establish any definite conclusion(s).

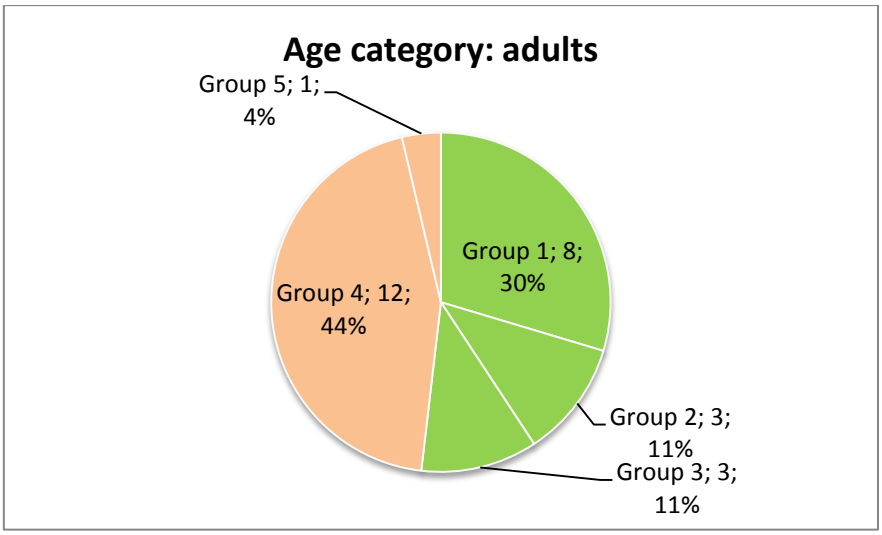

Figure 5.8: distribution of the adult individuals between the established groups; 100% = 27 individuals.

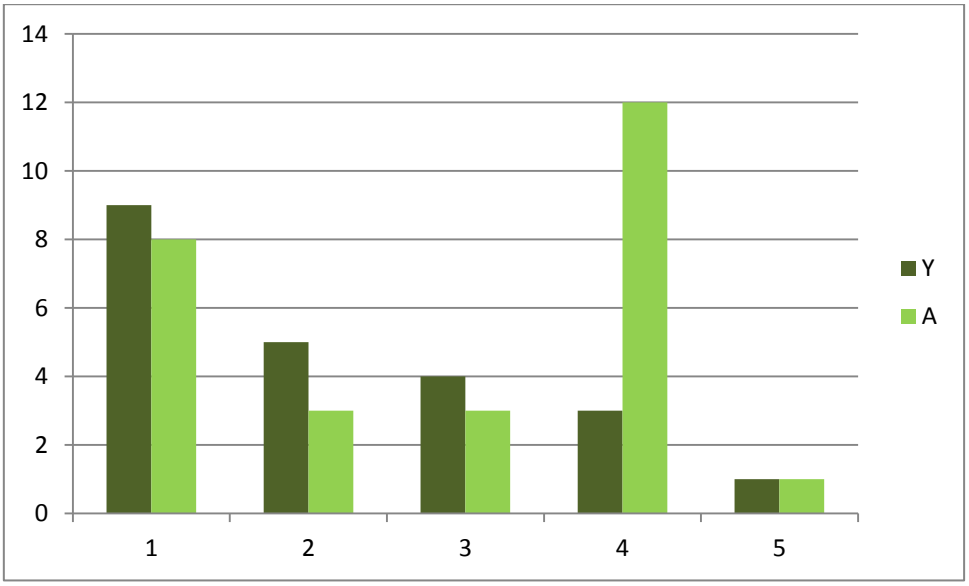

Figure 5.9: distribution of the adult (A) and young (Y) individuals in the established groups.

Age estimation and type of decoration(s)

The occurrence of specific types of decorations and age estimations were also analysed. For the three individuals of which the glass is similar as described by other sources, the age estimations were child, juvenile, and young adult. The remaining individuals documented with glass (n=5) consist of three young individuals and two adults. Therefore, it appears that this type of

decoration was more frequently present for the younger individuals. A similar analysis for the other decorations was difficult; the other decorations were not frequently documented or present in only one group to conduct such a comparison (e.g. Leonic wires).

Age estimation and patterns

To analyse any possible variation in the presence of specific patterns (pattern types 1, 2, 3, or 4) and the age distribution, these types of data were also combined. No individuals with a pattern were present in group 4 or 5; therefore, these groups were excluded. In group 1 (n=17), a total of 12 individuals were documented with a pattern. Among these 12 individuals, 4 were young individuals and 8 individuals were adults (table 5.18 and table 5.19).

Table 5.18: overview of the young individuals with a pattern and the physical anthropological data; from group 1. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

Pattern number	vnr	agecat	sex	age min	age max	AMstat (cm)
1	2009	J	U	12	16	
1	2243	Ch	U	2	4	
1	3087	A	M	20	25	167,55 ±3,27
2	1695	A	F	20	26	151,17 ±3,72

Table 5.19: overview of the adult individuals with a pattern and their physical anthropological data; from group 1. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

Pattern number	vnr	agecat	sex	age min	age max	AMstat (cm)
1	1024	A	M	54	60	170,6 ±3,27
1	1694	A	M	52	61	171,1 ±3,27
2	1260	A	M	42,33	48,33	162,85 ±4,05
2	1875	A	M	48	57	0
2	1887	A	F	61	66	159,7 ±3,55
3	1377	A	F	51	60	155,12 ±3,72
3	1927	A	F	50	59	160 ±3,72
3	4883	A	M	41	58	175,17 ±3,27

The 4 individuals presented in table 5.18 represent each young age category (child, juvenile, and young adults). Of these 4 individuals, pattern type 1 occurs most frequently; the same pattern occurs in the adult individuals only twice. The other patterns (2 and 3) occur more frequently in the adult group; this group was, however, also larger than the group for the young individuals. These data would suggest that a diadem-shaped crown was more frequently present in the graves of children and other young individuals and that the patterns 2 and 3 occurs more frequently in the graves of adult individuals.

Due to poor preservation, no individuals in group 2 were documented with a type of pattern. The preservation was better for the individuals from group 3; 5 individuals in this group were documented with a pattern (table 5.20). The individuals with find number 4453 and 5917, an adult and young adult respectively, were documented with the same type of pattern (pattern 3). For the individual with find number 4453 this was less pronounced than for the individual with find number 5917. This would mean that the occurrence of pattern 3 is not only limited to adult individuals, as was observed in the individuals from group 1. Both the individuals with find number 3797 and 6786 were the only individuals documented with pattern type 4 in this study; therefore a comparison was difficult. For both these individuals the age estimations were broad and therefore no conclusions regarding the presence of a fully enclosed wreath and age could be made. A full comparison could also not be made for pattern type 1 in this group, as this pattern was only observed for the individual with find number 6373. Even so, when compared with the individuals of group 1, it would still appear that a diadem-shaped crown occurs more frequently for young individuals.

Table 5.20: overview of the individuals with a pattern and the physical anthropological data; from group 3. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

Pattern number	vnr	agecat	sex	age min	age max	AMstat (cm)
1	6373	Ch	U	1	2,8	0
3	4453	A	F	40	80	0
3	5917	J	U	18	24	0
4	3797	A	U (F based on DNA)	21	???	0
4	6786	A	F	30	60	0

5.2.1.3 Sex estimation and funerary headdresses

Because a selection of individuals which were (probably) buried with a funerary headdress were young individuals, comparing sex data with the presence or absence of a funerary headdress was difficult. For some individuals, which were (probably) buried with a funerary headdress, there were data on sex available. In group 1, this was available for 10 individuals. Among these 10 individuals, 6 individuals were estimated to be male; the remaining 4 individuals were estimated to be female. Two of these individuals of which the sex estimation was available are young adults; one young adult was estimated to be male and the other young adult was estimated to be female. For both group 2 and group 3, data on sex were only limited available. In group 2, one male and two females were present; one of these female individuals was a young adult. For group 3, no male individuals and three female individuals were present (for the individual with find number 3797 this was established by DNA). All of these individuals were adults. In total, 9 females and 7 males were present in these groups. This means that in the groups for which the presence of a maiden was established, there was no difference between sexes. Even so, the majority of males was present in group 1, though it should be noted that half of the individuals estimated to be male (n=3) were 'possibly' buried with a funerary headdress; this was also true for the females in this group (n=2 with 'possible' funerary headdress).

When these data were compared with the sex estimations in group 4, there appears to be no difference. In group 4, data on sex were available for 14 individuals; 6 were male and 8 were female. Conclusively, no specific differences could be observed between sex and presence/absence of a funerary headdress; it should be noted that the sample size was small.

Sex estimation and type of decoration(s)

Though it was possible to analyse the presence of a type of decoration (i.e. reflective decoration) with the age estimation, this was not possible for the sex estimations. The majority of the individuals documented with glass fragments were, as mentioned, young individuals and therefore no sex estimation was established. Again, a similar comparison for other decoration(s) and sex estimation was not possible due to the low amount of documented decoration(s) and infrequent occurrence in groups.

Sex estimation and patterns

A comparison between data on sex and the presence of a pattern was only possible for the groups 1 and 3; this as no patterns were observed in the individuals from group 2. In group 1 (table 5.21), no females were documented with pattern type 1. This in contrast with the males; the majority of the male individuals (n=3) was documented with pattern type 1. Furthermore, 2 males and females were documented with pattern type 2; pattern type 3 was only documented once for the males and twice for the females.

Table 5.21: overview of the individuals with a pattern and the physical anthropological data; from group 3. Individuals are sorted by pattern number and sex estimation. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.

Pattern number	vnr	agecat	sex	age min	age max	AMstat (cm)
1	3087	A	M	20	25	0
1	1024	A	M	54	60	170,6 ±3,27
1	1694	A	M	52	61	171,1 ±3,27

Pattern number	vnr	agecat	sex	age min	age max	AMstat (cm)
2	1695	A	F	20	26	151,17 ±3,72
2	1887	A	F	61	66	159,7 ±3,55
2	1260	A	M	42,33	48,33	162,85 ±4,05
2	1875	A	M	48	57	0

Pattern number	vnr	agecat	sex	age min	age max	AMstat (cm)
3	1377	A	F	51	60	155,12 ±3,72
3	1927	A	F	50	59	160 ±3,72
3	4883	A	M	41	58	175,17 ±3,27

As data on sex for the individuals in group 3 is limited (three sex estimations, all female), no comparisons between presence of a pattern type and sex can be made.

5.2.1.4 Chemical analysis: patterns/objects

In the paragraph for the chemical criteria the difficulty to use the chemical data to identify a funerary headdress was already discussed, and also the difficulty to differentiate between a funerary headdress and 'normal' objects. Even so, at least two groups were observed in the Cu/Zn ratios for the crown individuals. Figure 5.10 presents all of the chemical data for the individuals under study (crown individuals as well as the other remaining individuals). The outliers were already discussed, as well as the discolorations with a low amount of Cu and Zn. However, for the remaining Cu/Zn values, two groups were also distinguished in the complete dataset. Again, the majority of the measurements fall in the brass ratio; a selection of measurements did have a higher amount of Cu present, though these were not complete outliers. This would mean that again a brass group and a 'jewellery' group were present in the complete chemical dataset. To analyse possible patterns in the distribution of these various Cu/Zn ratios, data on such as sex estimation, group number, and locations such as postcranial regions, among others, were compared with the chemical data.

It should be noted that for all figures presented below, the find numbers are not displayed for practical reasons; the clustering of most data resulted in unreadable find numbers as labels.

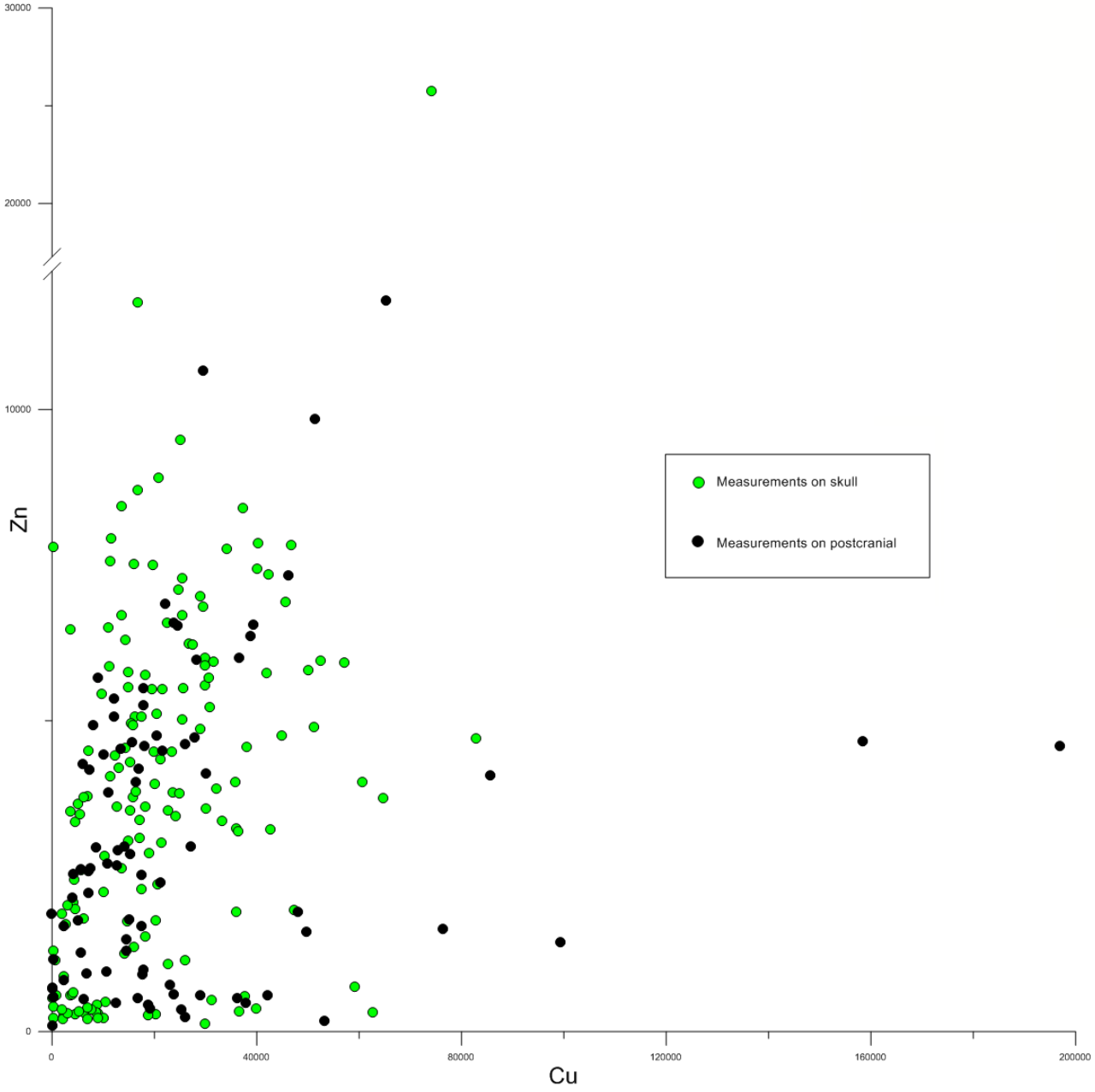

Figure 5.10: scatter plot of Cu/Zn ratios taken on the complete dataset.

Chemical data and age estimation

For the crown individuals, it was discussed that the younger individuals had frequently a higher amount of Cu in the discoloration(s) than the adult individuals. Though no definite conclusions could be made because of the low number of crown individuals, these data were also compared with the complete chemical dataset to analyse this further (fig. 5.11).

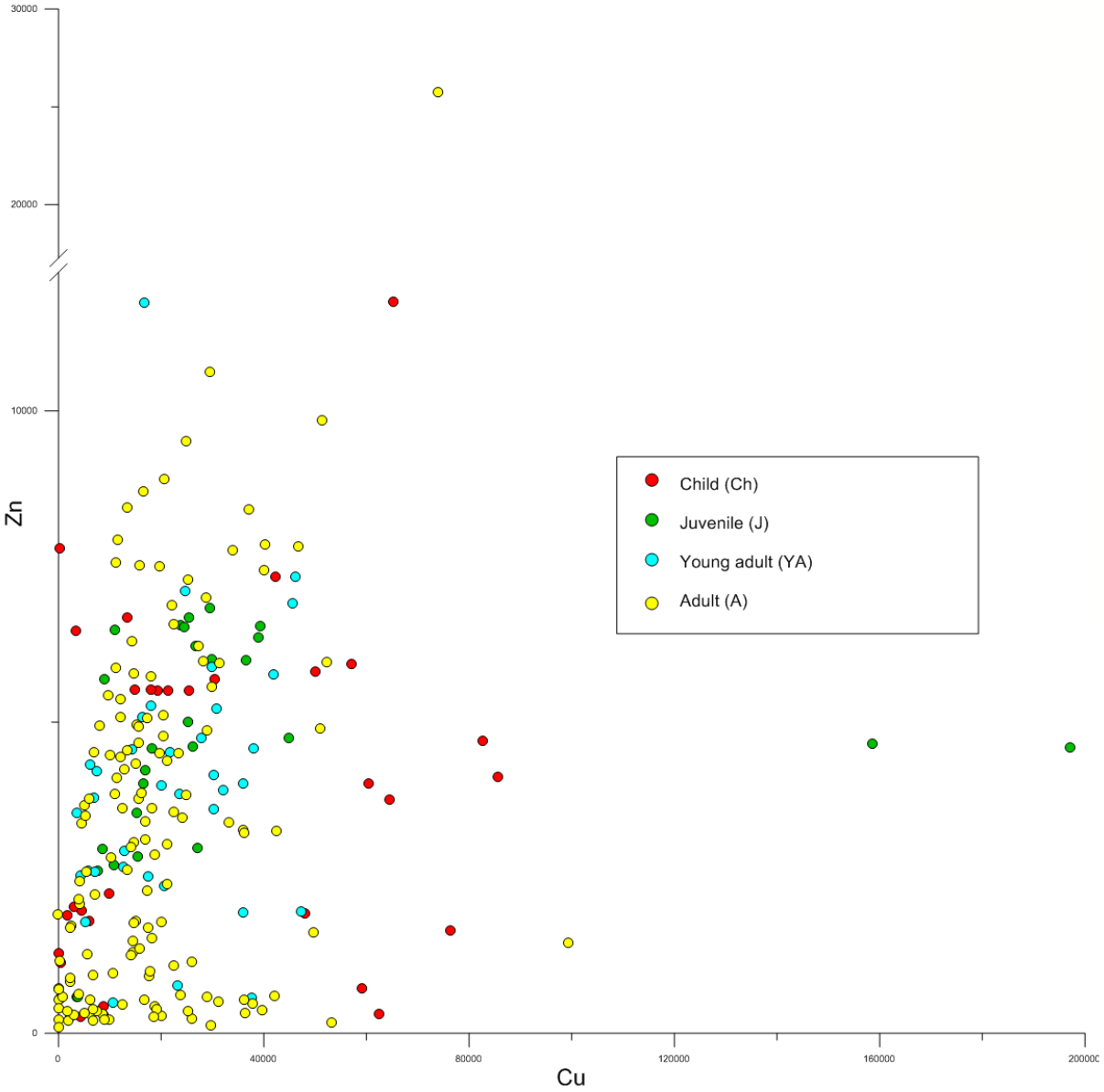

Figure 5.11: scatter plot of Cu/Zn ratios on the skull and postcranial bones; sorted/selected by age category.

In the complete dataset, a few of the measurements taken at discoloration(s) for adult individuals had a relatively higher amount of Cu as well; however, the majority of the young individuals also seemed to have Cu/Zn ratios corresponding with brass. It was therefore difficult to observe a distinct pattern regarding Cu/Zn ratio and age estimations.

Chemical data and sex estimation

No distinct pattern regarding Cu/Zn ratio and sex estimations could be made for the crown individuals; figure 5.12 presents the complete dataset.

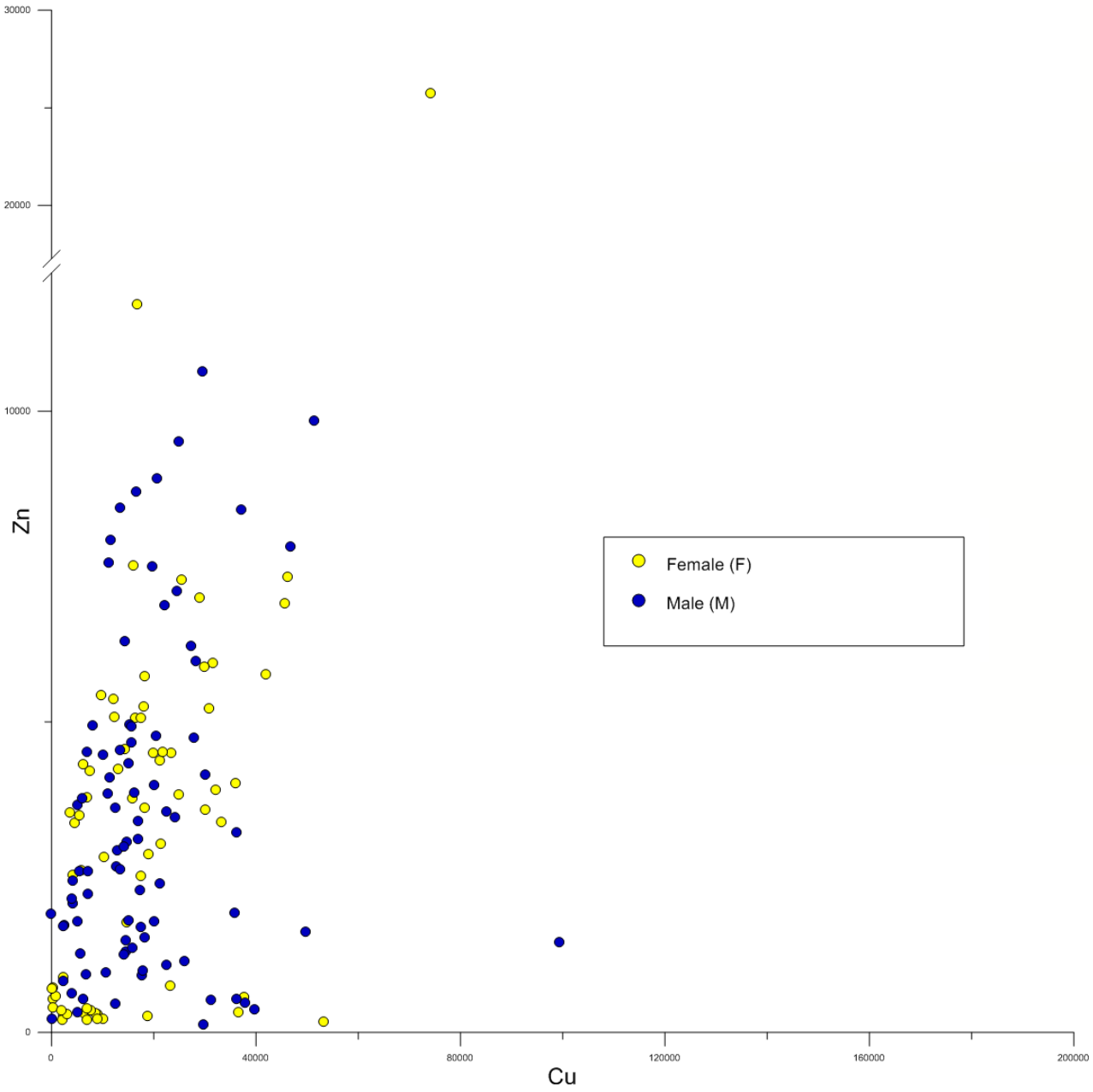

Figure 5.12: scatter plot of Cu/Zn ratios on the skull and postcranial bones; sorted/selected by sex category.

As can be seen in figure 5.12, no distinct pattern for the Cu/Zn ratio and sex estimation can be observed. A few measurements did contain a higher amount of Cu, but both males as females were represented in this Cu/Zn ratio.

Chemical data and established groups

The previously established groups as discussed in paragraphs 5.1.2 and 5.1.3 and the chemical data could not be compared earlier. It would be expected that the groups with a funerary headdress present would show different Cu/Zn ratios than the groups without a funerary headdress; figure 5.13 presents the complete dataset.

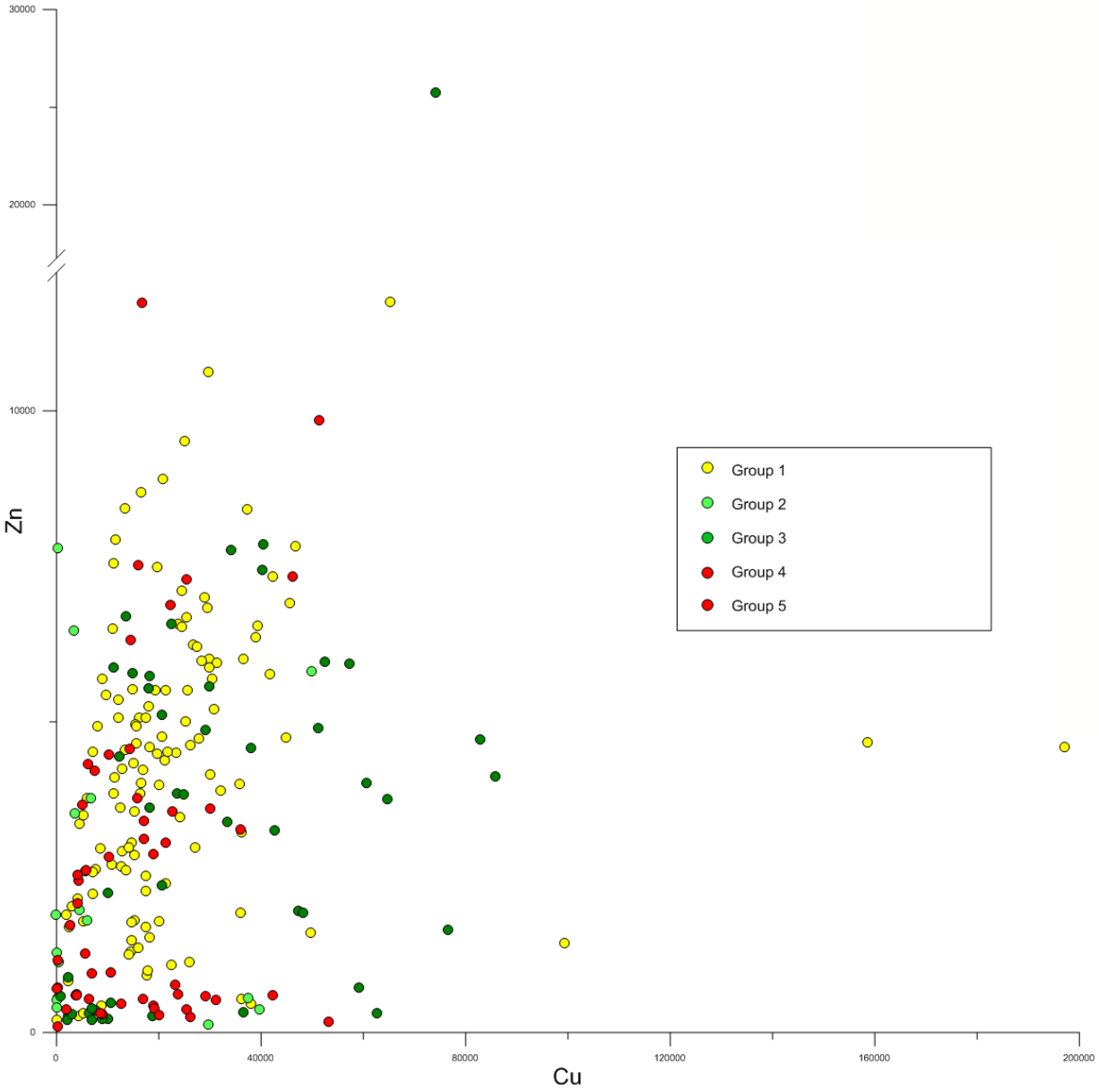

Figure 5.13: scatter plot of Cu/Zn ratios on the skull and postcranial bones; sorted/selected by group.

Unfortunately, no distinct pattern between the groups and chemical data could be observed. It can be noted that the chemical data for group 3 (crown individuals with sufficient discolorations/finds) show more Cu/Zn variation than the other groups. For all other groups, the majority of the measurements fall in the brass ratio.

Chemical data and pattern number

The chemical data on the patterns in discoloration documented for the crown individuals indicated that areas of the frontal had relatively a higher amount of Cu; however, due to insufficient data no definite conclusions could be made. The chemical data for all the other individuals with a pattern in discoloration (all in group 1) were combined; this is presented in figure 5.14.

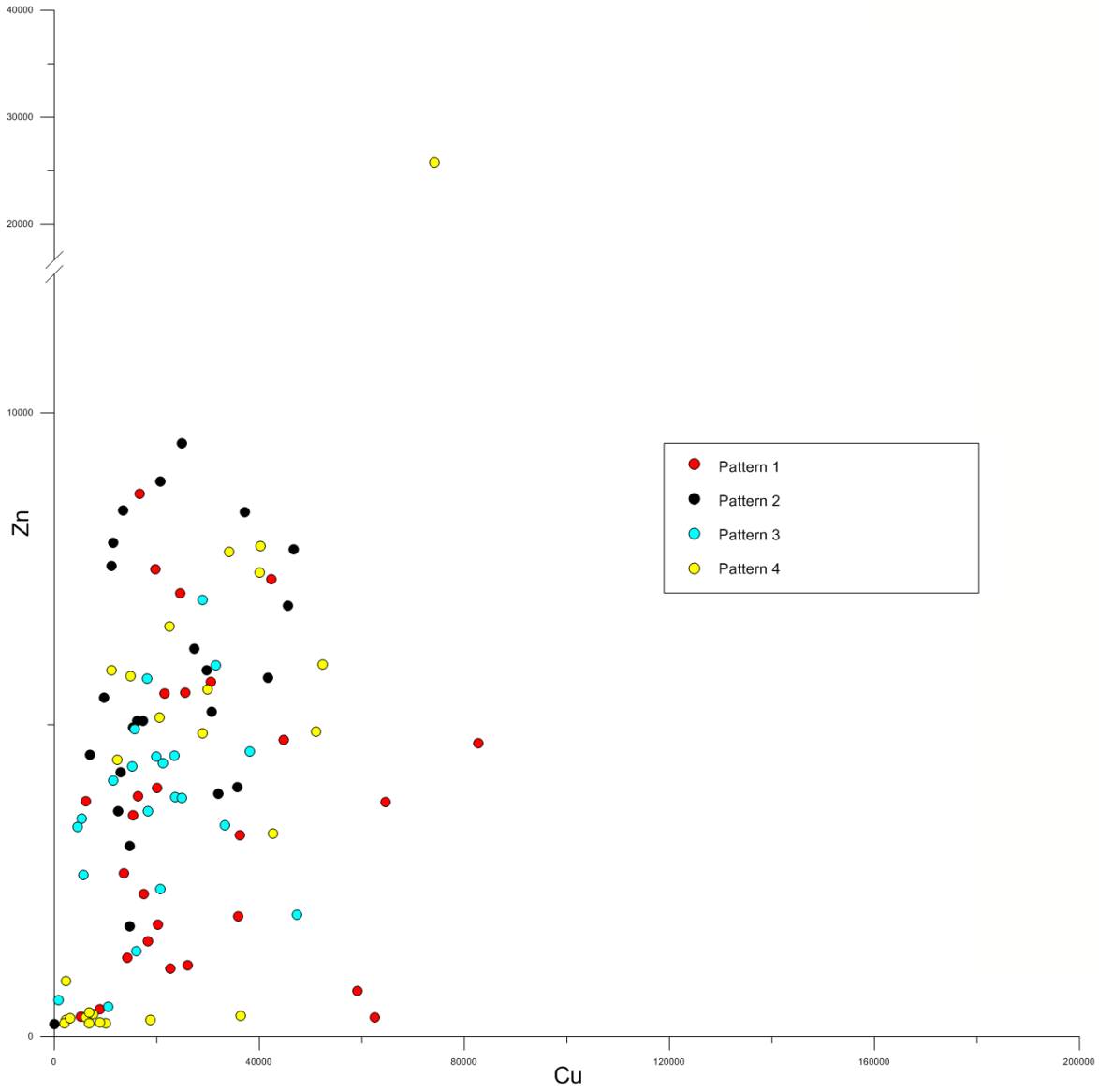

Figure 5.14: scatter plot of Cu/Zn ratios on the skull; sorted/selected by patterns.

Again, no distinct differences could be observed; it is notable that the outliers are present for pattern 1. This is, however, only one individual (find number 6373, as previously discussed) and therefore no definite conclusions can be made regarding this.

Chemical data and postcranial regions

Discolorations on postcranial regions were not well represented for the crown individuals, but the measurements for the remaining individuals provided additional data. Figure 5.15 displays the complete dataset of measurements taken at postcranial locations.

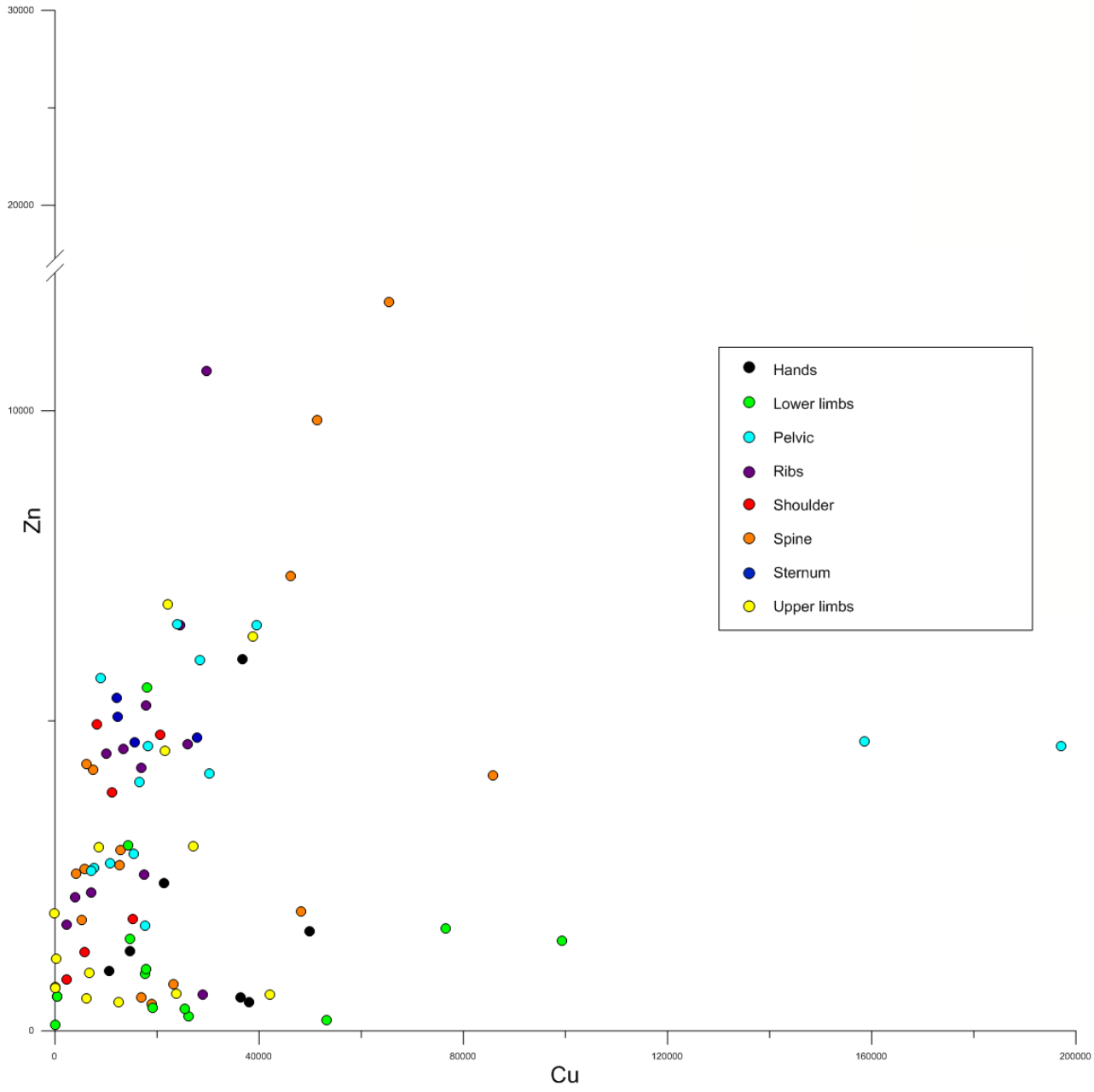

Figure 5.15: scatter plot of Cu/Zn ratios on the postcranial bones; sorted/selected by body region.

However, even with these additional chemical data it was not possible to specifically distinguish certain objects by Cu/Zn values. As previously mentioned, two groups can only be distinguished in the chemical data; the brass group and the group with a higher amount of Cu. It can be observed in figure 5.15 that the postcranial regions of the sternum, shoulder, ribs, and pelvic area only fall in the brass group (with the exception of the two outliers on the pelvic area for the individual with find number 5830). Additionally, measurements taken at the postcranial regions of the hands, upper limbs, lower limbs, and the spine fall both in the brass group as well as the high Cu group. This implies that brass objects, such as pins, buttons, or buckles, appear to be present in each postcranial region. In addition, the higher Cu group appears to be only present in certain (aforementioned) postcranial regions. It may therefore be possible, as the higher Cu group possibly represent decorative objects such as jewellery, that decorative objects were present in these postcranial regions. It was again difficult to identify specific objects, but it is remarkable that the postcranial regions of the hands, upper limbs, lower limbs, and the spine all had discolorations containing both a high amount of Cu and the ratio of brass. This may also indicate that preservation and taphonomical processes do not influence the Cu/Zn ratio in the discoloration(s); if this was the case, the Cu/Zn ratios would be similar within and for each body region.

The discolorations on the spine were further analysed. It was observed that the cervical and lumbar vertebrae had discolorations that fall in the brass ratio, whereas the measurements for thoracic vertebrae contained a higher amount of Cu. This may be associated with the presence of jewellery (e.g. necklace). The brass discolorations may again be from pins, buttons, or wire rings/eyelets. In addition, the Cu/Zn ratio on the lower spine was similar as the Cu/Zn ratio of the pelvic. However, no similarities were present for the Cu/Zn ratios of the upper spine values and the ribs; this may be the result of the movement of objects or the presence of different objects.

Additionally, the chemical data for a few individuals showed noteworthy (correlating) Cu/Zn ratios. The individuals with find number 1887 and 1875 were documented with the same type of pattern type on the skull, but also with the same discolorations on the manubrium/ribs (fig. 5.16). The Cu/Zn ratios of the discolorations on both manubriums show similar Cu/Zn ratios, as well as the discolorations on the ribs. This may indicate that possibly for both individuals a similar object was present in the neck/chest region.

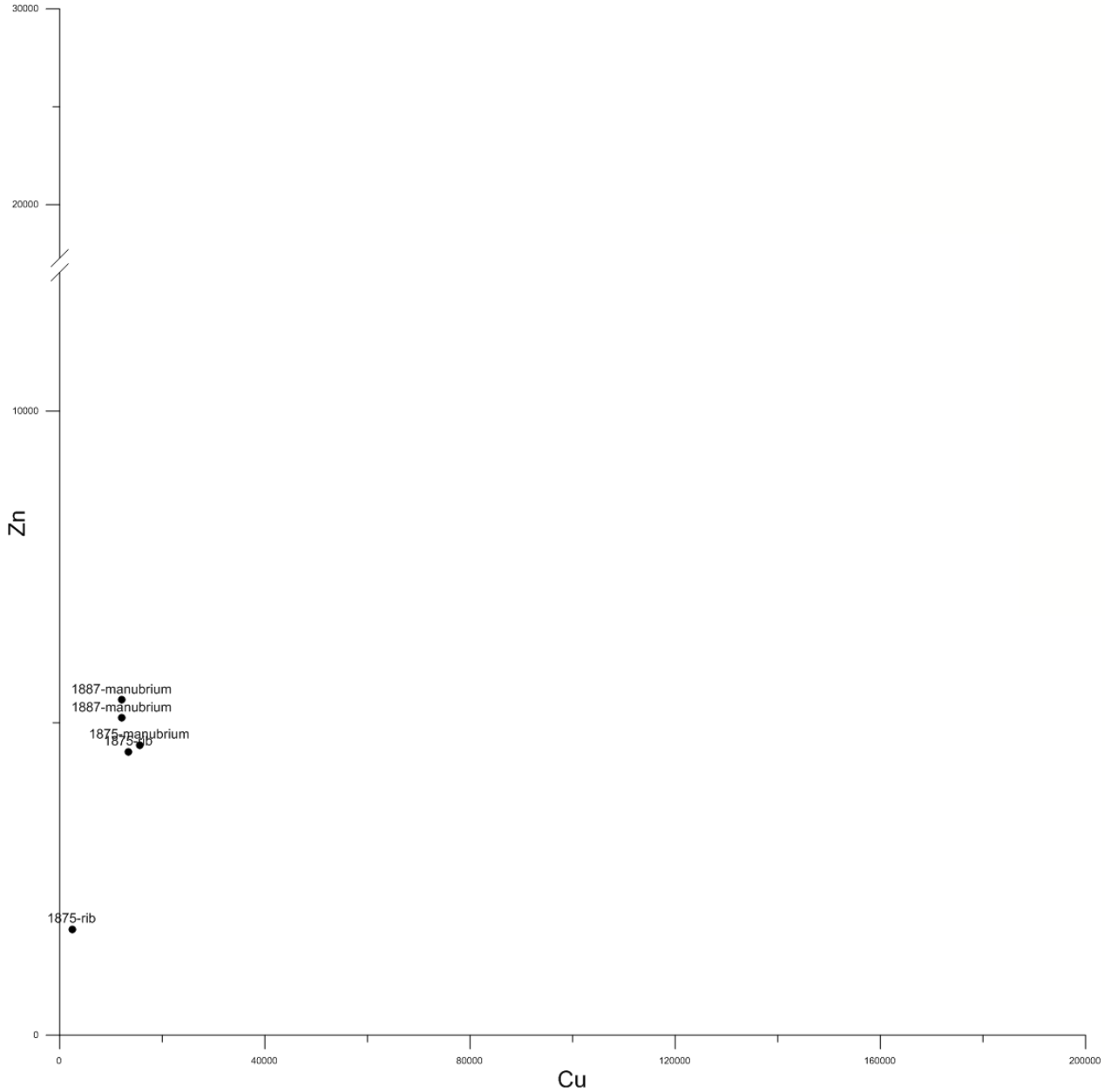

Figure 5.16: scatter plot of Cu/Zn ratios on the manubrium for the individual with find number 1887 and manubrium-ribs for the individual with find number 1875.

Chemical data skull (regions)

It was observed for the crown individuals that measurements taken at the frontal region would contain a higher amount of Cu when compared with other skull regions. This was, however, only based on data from two individuals (find numbers 3797 and 6373) and therefore no definite conclusions could be made. In addition, differences between skull regions were only observed for the individual with find number 3797; the parietals and occipital fell in the brass group, whereas the frontal fell in the higher Cu group. It was analysed if these differences could be observed for the other individuals; figure 5.17 presents the complete dataset for the skull regions.

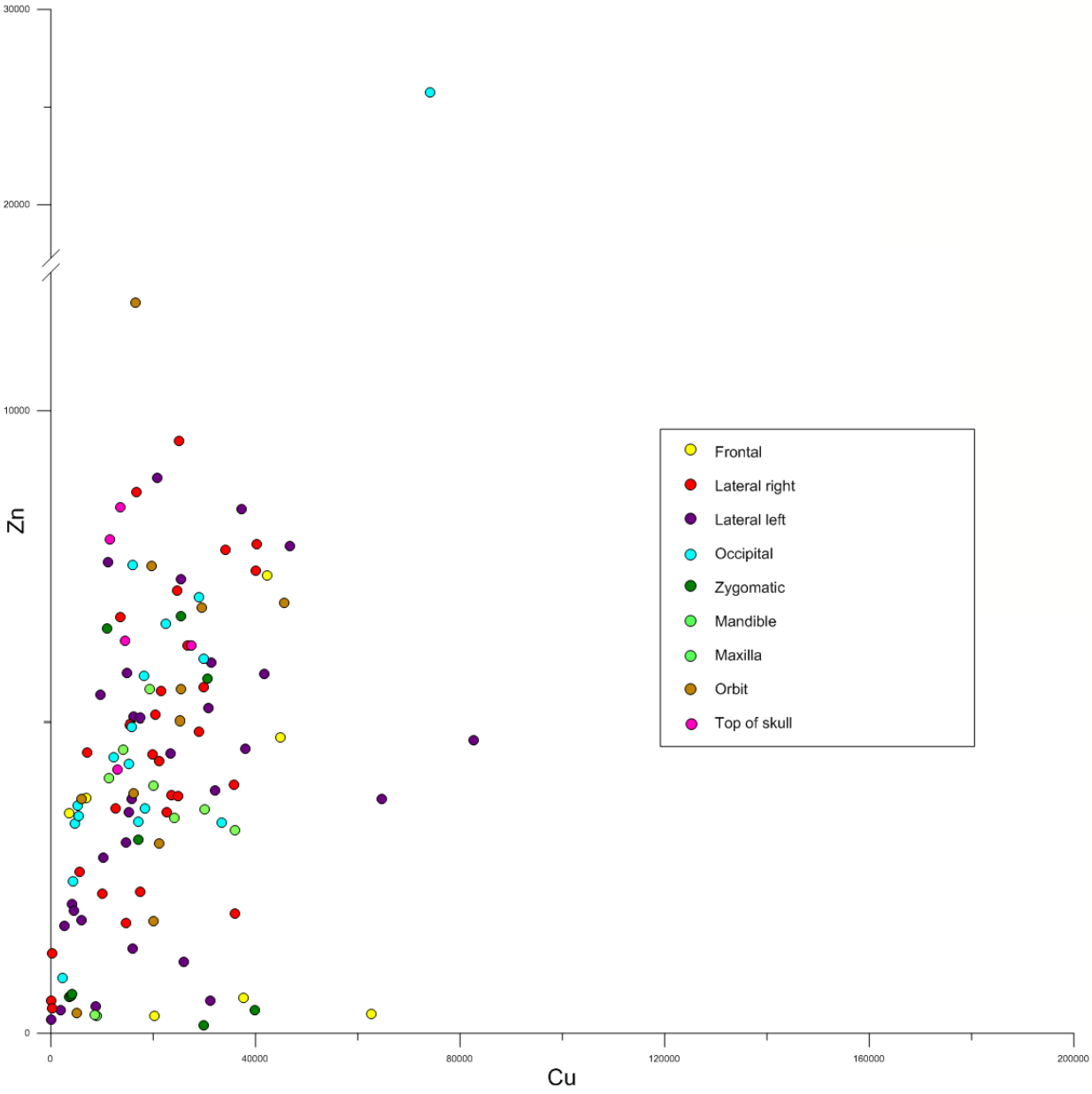

Figure 5.17: scatter plot of Cu/Zn ratios on the skull; sorted/selected by skull region.

Unfortunately, a distinct pattern between skull region and Cu/Zn ratio could also not be observed for the complete dataset. The regions of the zygomatic and lateral left show more variation in the Cu/Zn ratio than other regions; however, this merely because of the outliers, which were crown individuals (find numbers 4139 and 6373). The frontal region also does show variation in the Cu/Zn ratio, but no distinct pattern could be observed due to lack of data. In addition, analysing all measurements taken on the skull (regardless of region), the Cu/Zn ratios show a lot of variation; both brass Cu/Zn ratios and high Cu ratios were represented. However, no distinct pattern could be observed, though it should be noted that the majority of the high Cu measurements were from the previously discussed crown individuals and from the individuals with find number 1694 and 3087.

5.2.2 Findings Oldenzaal compared to known archaeological data

In the background chapter, various archaeological examples of funerary headdresses from the Netherlands as well as Europe were described. Though generally the funerary headdresses appear to be similar, it was also concluded that some decorations are probably local - or regional - variation(s) of this burial custom. Therefore, data on decoration and appearance of the funerary headdress from this study will be compared to archaeological data and historical data; the findings of this study can then be placed in a larger context.

5.2.2.1 Discoloration(s): comparison of patterns

Discolorations on the skull and pattern types

The archaeological examples and the historical data presented in the background chapter provided some data on the location of a funerary headdress, and therefore also possible patterns in green discoloration; the previously mentioned pattern types. As already discussed in paragraph 5.1.1.2, historical data (e.g. Van Sasse van Ysselt, 1897; Portegies, 1999) indicate the usage of a wreath/arch near the head (from shoulder to shoulder) or near the shoulders; which are differentiated respectively by wreath: arch A and wreath: arch B in this study. This corresponds with the documented pattern types 2 (arch A) and 3 (arch B) documented in this study. However, other historical data (e.g. the photographs (1900-1911) presented in the background chapter) also indicate the usage of a funerary headdress as a diadem (pattern type 1 in this study) or around the head (cap-like element or enclosed wreath; pattern type 4 in this study). This implies that, though there is variation, all documented pattern types in this study can be correlated with the different types of decoration(s) which are mentioned in the historical data.

From the archaeological data, the reconstruction of the funerary headdress excavated in Didam (the Netherlands) indicated that a diadem-shaped crown (pattern type 1 in this study) was present. However, often for other archaeological examples, no specific pattern in the discoloration was observed or specifically documented by the reporter(s); though 'around the skull' occurs frequently (e.g. Oosterhout, Sittard, and Belgian sites). This would mean that only the presence of pattern types 1 or 4 occurs frequently in archaeological examples.

The results of this study indicate that the pattern types 1, 2, and 3 are equally present (n=6, n=4, and n=5 respectively) and pattern type 4 is not well represented (n=2) in the complete dataset; though the latter pattern type is represented by crown individuals. Pattern type 2 is, however, not represented by crown individuals and only two crown individuals were documented with pattern type 3. However, observing specific patterns in the discolorations of the crown individuals (and of course also in the complete dataset) was difficult; these were not always visible due to fragmentation and/or preservation. Even so, the occurrence of all pattern types in

the complete dataset of this study indicates that a) a diadem-pattern or enclosed wreath is often present, which is similar in archaeological and some historical sources; b) the wreath/arch around the skull/near the shoulders also occurs frequently in this study, which is described only in historical data (e.g. as presented by Portegies (1999) for Den Bosch) and not in archaeological data. Based on the complete dataset of the patterns in discolorations, it would mean that the results of this study correspond with both archaeological and historical data; even though for some individuals the observed pattern type could not be definitely established. Moreover, it is remarkable that for no previous archaeological examples the presence of pattern types 2 and 3 were documented; the presence of these pattern types in Oldenzaal only corresponds with historical data.

Postcranial locations

As previously discussed, the presence of a wreath on a postcranial location (e.g. hands, feet) as part of this burial custom may be a possibility. Examples of wreaths placed in the hands or near the feet were only present in the archaeological data from Germany; no examples for the Netherlands appear to be documented. However, Van Sasse Van Ysselt (1897) mentioned that for young children, either a sprig of flowers (real or artificial) or palm branch could be placed in his or her hands. The presence of a funerary headdress can appear simultaneously with this. In this study, two of the crown individuals were documented with discoloration on postcranial bones, which also contained a high amount of copper. For the individual with find number 6451, the chemical data of the discoloration on the tibia correlated with the chemical data of the funerary headdress present for this individual. The individuals with a possible/probably funerary headdress were also documented with discoloration(s) on postcranial locations, though for some these may not be associated with a funerary headdress (i.e. small locations). For other individuals, such as find number 1694, the amount and appearance of discoloration can indicate the associated decorations of a funerary headdress on postcranial locations. The presence of organic material and green discoloration on postcranial locations for the individual with find number 5830 were very likely also elements of decorations used in this burial custom; in combination with the presence of a funerary headdress. Therefore, results of this study do, even though limited, correspond with archaeological data from Germany and historical data from the Netherlands on this aspect. However, it is remarkable that decorations on postcranial locations were mentioned by historical data for the Netherlands, but were never observed in archaeological context. Frequently, at the location of the hands a rosary can be present; though this is less likely for the aforementioned individuals. Unfortunately, as no clear differentiation between 'normal' objects and decorations of a funerary headdress could be further made based on chemical data and appearance of the discoloration, it was difficult to make a comparison for the other individuals under study.

5.2.2.2 Decoration(s) and finds

Table 5.22 provides an overview of each documented decoration for funerary headdresses from both archaeological and historical data, and also includes the documented decorations in this study. As can be observed in table 5.22, based on a few decorations, the funerary headdresses of Oldenzaal have some similarities with funerary headdresses from other regions.

Table 5.22: overview of the various decorations of a funerary headdress (first column) and their presence (first row) in Oldenzaal and previously discussed archaeological sites, as well as historical data.

Type of decoration	Oldenzaal (NL)	Haarlem (NL)	Oosterhout (NL)	Den Bosch (NL)	Didam (NL)	Sittard (NL)	Bosco Gurin	Belgium	Germany	UK	Hist. data (NL)
Leonic wires/Leonic flowers	x				x				x		
Copper wires/copper residue	x	x	x		x			x	x		
Iron wires						x		x			
Beads (glass)					x			x	x		
Fringes metal									x		
Leaf-flower objects of metal									x		
Glass	x			x				x			x
Other reflective decoration				x							x
Pearls or imitation pearls									x		
Sequins					x				x		
Flowers/ Rosemary		x		x			x	x		x	x
Leaf-flower object of organic material	x			x			x	x		x	x
Paper/ribbon				x	x		x	x	x	x	
Textile/fabric/ clothing					x	x	x	x	x	x	
(green) herbs											x
leaves			x					x			x
Other?							dress				Shroud decorated

Leonic wires and copper wires

As expected, the presence of copper wires and/or copper residue is frequently documented; this means that the finds of Oldenzaal correspond with the majority of the sites presented in table 5.22. However, the specific funerary headdress decoration, the Leonic wires and/or flowers, were only documented for archaeological sites from Germany. These specific Leonic wires, identified solely on their appearance, were also mentioned for the archaeological example from Didam (the Netherlands). Unfortunately, only chemical data on the Leonic wires from Germany are present; for all other aforementioned archaeological examples it is not possible to determine with certainty that these copper wires were made of Leonic wires. Even so, the probable presence of copper wires or metal wires can also indicate that there can be a variation in the decoration(s) (e.g. brass wire used as substitute). Remarkably, in historical data the usage of copper/metal wires was not frequently mentioned, which does not correspond with archaeological data; a comparison was therefore difficult.

The analysed crown elements in this study could be chemically distinguished from 'normal' objects; and it was therefore also concluded that, given the similarity in the chemical data as presented by Lippok (2013), these were Leonic wires. Unfortunately, their appearance did not always correspond with the description of the Leonic wires; in some cases their original shape was not maintained. However, it should be noted that for the majority of the crown elements the characteristic entwined and curled appearance was still visible. As previously mentioned, only for one individual (find number 5917) the Leonic flowers were still intact; their chemical data did, however, not correspond completely with the expected chemical composition of a funerary headdress. Even so, the presence of Leonic wires, and to some extend Leonic flowers, correspond with decorations documented for sites in Germany, as well as the site of Didam.

Reflective decoration/glass

The usage of reflective decorations, as described in the background chapter, was mentioned by Van Sasse Van Ysselt (1897) and Portegies (1999) for the Netherlands; both describing the ritual for the province of Brabant. Both mention the usage of glass, slivers of tinfoil, and/or gold-like paper; apparently a commonly used decoration in the southern region of the Netherlands. In addition, the presence of glass in this burial custom was also documented for some archaeological sites in Belgium, though these have frequently a specific shape; an aspect not reported by Van Sasse Van Ysselt (1897) and Portegies (1999) for the Netherlands. However, all three sources present generally a similar decoration as documented for Oldenzaal; associating therefore the usage of this specific decoration in this burial custom with the more southern regions of the Netherlands and the region of Belgium with the site of Oldenzaal. Remarkably, only the usage of glass as a reflective decoration was established for Oldenzaal; the other reflective decorations by Portegies (1999) were not documented. It may be possible that the

lack of other reflective decorations, and relatively low amount of glass, are the result of poor archaeological visibility; this will be discussed in paragraph 5.2.3. The lack of reflective decorations documented for the other sites may also be the result of poor archaeological visibility; it may very well be that, for example, slivers of tinfoil were used as reflective decoration, but were not preserved. However, the possibility that such reflective decorations were not used in other and similar regions of the Netherlands (e.g. Haarlem, Oosterhout, Didam) as well as the previously discussed sites from Europe, should not be overlooked (regional variation).

Organic material (with and without copper objects)

The aforementioned reflective decoration was for the site of Den Bosch and sites from Belgium also in combination with organic material. For these sites the presence of flowers, frequently artificial (i.e. made from paper), was documented in combination with glass fragments, and of course copper elements. However, flowers were also used in the funerary headdresses documented in the United Kingdom and Germany, but have also been reported in historical sources. These were, however, not documented in combination with the presence of reflective decoration.

For at least one individual in this study, the combination of reflective decoration and organic material is also present (the individual with find number 5830). The oval-shaped objects of organic material documented with this individual can be interpreted as a flower or leaf ornament. The organic decorations for this individual correspond with the findings of the sites of Den Bosch and Belgium; similar as for the reflective decorations. The individual with find number 5830 was also documented with a copper ring containing some organic residue. A similar decoration was also reported for a site in Sweden (Linköping, not in table 5.22); this consisted, however, of larger copper rings entwined with organic material. Material from Germany, and some sites in the Netherlands, also indicates the usage of copper wires (besides the usage of Leonic wires) entwined with organic material. Though the object documented with the individual with find number 5830 was copper wire formed into a ring, this object has similarities with these decorations. Other organic material frequently used in funerary headdresses, based on historical data and archaeological data, indicate the usage of rosemary. However, the small amount of organic material from this study was not further analysed, so it could not be established if rosemary was present in the funerary headdresses of Oldenzaal. The overall lack of organic material for this study generally limited a comparison with the majority of the sites presented in table 5.22, as these sites documented relatively more organic material for this burial custom. To some extend this is also true for the inorganic material (e.g. sequins, beads); limiting again possible correlations between sites.

5.2.2.3 Comparison of data on burial custom and conclusions

In paragraph 5.2.1 the presence of a funerary headdress was analysed with data on the biological profile of the individuals; this was compared with the data presented in chapter 2, to analyse possible similarities or differences. The historical data indicate that this burial custom is for "everyone, unmarried and regardless of age"; indicating sex and age are not relevant. This is also supported by other archaeological examples (e.g. Sittard). However, other examples point to a more frequent use of this burial custom for (very) young individuals and unmarried young females; Tagesson (2015) reports that this burial custom for the site in Linkoping was mainly found in graves of (young) females and new-born females. Contrarily, other data from archaeological sites in Sweden did indicate the usage of this burial custom for both sexes, and also regardless of age (Tagesson, 2015). Similar examples were also present in the Netherlands. Conclusively, there appear to be different concepts on the age and sex aspects and this burial custom.

The results of this study also show a similar variation in age and presence of a crown, making it difficult to definitely conclude if age and funerary headdresses are correlated. As discussed in paragraph 5.2.1.2, the adults and young(er) individuals were equally distributed in at least two groups where a funerary headdress was present; indicating that both adults and young(er) individuals were buried with a funerary headdress. When these groups were compared to a group where no funerary headdress was present, it was concluded that more young(er) individuals were present with a funerary headdress. This concluded that even though younger individuals appear more frequently with a funerary headdress when compared with the complete dataset, there seems to be no difference in age between the individuals with a funerary headdress. No difference between sex and the presence of a funerary headdress was present.

Conclusions comparison(s): for who is the crown and type of decoration

As for what kind of individuals was frequently buried with a funerary headdress, combining these aforementioned data, and the results of this study, it would appear that this burial custom is indeed for "everyone, unmarried and regardless of age". It should be noted that, however, children and young females tend to be more often buried with a funerary headdress.

The comparison of discoloration(s)/pattern types and the documented decorations of the funerary headdresses in Oldenzaal with both archaeological and historical data indicated various similarities. The documented discoloration(s)/pattern types in this study did correspond with both archaeological and historical sources; though there appears to be variation present in type of pattern and type of source. As for decorations, the Leonic wires did only correspond with the site of Didam for the Netherlands and generally with the examples from Germany. The

presence of reflective decoration, only glass fragments for Oldenzaal, corresponded with both archaeological and historical data from Brabant, as well as archaeological data from Belgium. This would imply this specific decoration had a specifically a southern point of origin (local variation); though it may also be possible that lack of reflective decoration in other sites (both Netherlands as well as Europe) is the result of poor archaeological visibility. Organic material was documented for most of the archaeological examples and historical data, though the specifically flower/leaf-shaped object documented for an individual in this study could be associated with the sites in Brabant and Belgium. Other inorganic decorations (i.e. copper ring) could be associated with archaeological data from Sweden and Germany. Solely based on type of decorations used in the funerary headdresses of Oldenzaal, it would seem that there is a similarity in the construction/appearance of these funerary headdresses with data from the southern regions of the Netherlands as well as Belgium. This may possibly be a local/regional variation, though the poor archaeological visibility of certain decorations should not be overlooked. In addition, it should be taken into account that both the southern regions of the Netherlands as well as the eastern regions of the Netherlands were Catholic; this may explain the similarities. However, funerary headdresses were also observed in other (Catholic) regions of the Netherlands; though no association based on finds could be fully made with these crowns.

5.2.3 Archaeological visibility of the funerary headdresses

The main research question for this study was to analyse the archaeological visibility of a funerary headdress and how this burial custom can be identified in archaeological context. This is of course interrelated, and while analysing the presence of funerary headdresses in this study, it became clear that both were highly influenced by some aspects. One of these aspects was the preservation. However, results of this study did also indicate that probable differences in how the burial custom was conducted (i.e. construction and type of decoration) can also influence the archaeological visibility, as well as other aspects.

Archaeological visibility

The skeletal material from Oldenzaal was buried in sandy soil, which had consequences for the preservation of bone and other material, such as the decorations of a funerary headdress. There is of course a difference between the inorganic (e.g. Leonic flowers, glass, etc.) and the organic (e.g. flowers, leaves, etc.) decorations used in a funerary headdress and their archaeological visibility. Based on historical and archaeological data, the decorations used in the funerary headdresses contain frequently organic material. As these organic materials generally do not preserve well, the archaeological visibility of this burial custom can be overall poor. Both the archaeological data as well as the results of this study have indeed indicated that generally a low amount of organic residue was present. For this study, organic flower-shaped decorations were documented for the individual with find number 5830, but no organic decoration similar to this was documented for the other individuals. Overall, organic residue was documented for a few individuals, but this was often indeterminable. As said, the poor preservation of these organic decorations has effect on the archaeological visibility of this burial custom. Wreaths, diadems, or other crowns made of only or containing mostly organic material can therefore be almost 'invisible'; unless soil conditions permit preservation of organic material. This would imply that the inorganic material is archaeologically more frequently visible for this burial custom; i.e. the crown frame. Though inorganic material was documented for other archaeological examples of a funerary headdress, this was not substantial in this study. The used inorganic decorations or the frame itself can also be poorly visible due to fragmentation; this aspect is somewhat interrelated with the methods of archaeological excavation and post-depositional processes. Furthermore, Tarlow (2015) mentions that the archaeology of death in the more 'recent' periods (i.e. Late Medieval and Post-Medieval time periods) is not well researched archaeologically. This became also clear in the background chapter; though archaeological examples and historical sources on funerary headdresses do exist, these were not substantial. The fact that generally the burial customs from these time periods are not well researched results also in a limited view on the funerary headdresses. Therefore, only limited data is available, which results in possibly 'overlooking' this burial custom, as knowledge on this

burial custom and methods of archaeological excavation do not exist - or are only limited. Both the lack of current research on this burial custom as well as preservation and/or fragmentation are of importance for the archaeological visibility.

For instance, the reflective decorations documented during this study (i.e. glass fragments) were only documented for 8 individuals. For only three of these individuals, the glass fragments were similar in appearance as the expected reflective decorations for this burial custom. The glass fragments documented for the remaining individuals were different in appearance, and it cannot be concluded with certainty if this glass was used as reflective decoration. As the expected glass fragments used in this burial custom are small and thin, their presence can be frequently overlooked; their archaeological visibility depends therefore on excavation methods and/or further processing and analyses of the material. Linked with this is that if the glass fragments are not known to be an aspect of this burial custom, they may also be 'overlooked'. However, they can also be completely absent due to taphonomical processes (preservation) or regional variation (as previously discussed in paragraph 5.2.2.2). The aforementioned aspects may also be the reason for the lack of other reflective materials documented during this study.

Furthermore, elements of the crown (i.e. Leonic wires/flowers or copper wires in general) were only documented for the crown individuals in this study. Though the elements were not as small as the aforementioned glass fragments, they do not appear to be frequently present. The preservation of these inorganic decorations may be better; their archaeological visibility can still be poor. Unless present as a complete crown, the appearance of the Leonic wires can be different than expected; the chemical data of the crowns under study did indicate Leonic wires, but their appearance did not always correspond with the characteristic description of a Leonic wire/flower. If a specific shape and construction of a funerary headdress is expected but not present, the burial custom may again be 'invisible'. The usage of, for example, normal copper wires instead of Leonic wires may be interpreted differently, e.g. as 'headgear'. Furthermore, it may be possible that different types of decorations were constructed, indicating a local variation or interpretation, which may also limit the archaeological visibility. The possibility of local variation was already mentioned for a few decorations, but this aspect can also be present for other decorations. Local variation in organic material (e.g. leaves or rosemary) as well as any inorganic material can influence the archaeological visibility. In addition, this may also be time period related. As already mentioned, during the Protestant Reformation, this burial custom was infrequently conducted differently or completely absent. Though this has not been established with certainty for Oldenzaal, it should be taken into account that such variation in the burial custom can also be present. These alternative funerary headdresses can, however, also result in a poor archaeological visibility as these will contain less obvious decorations than a complete crown.

However, other expected inorganic decorations for this burial custom, as presented in paragraph 5.1.1.4, were not documented at all during this study; this of course with the exception for the sequins documented for the individual with find number 5917. This could be again the result of preservation, excavation methods or local variation; the general absence of these decorations did, however, limit the archaeological visibility of the funerary headdresses under study.

Even though these inorganic decorations can be reliable indicators for the presence of a funerary headdress, their relatively poor archaeological visibility implies that a funerary headdress would frequently be only archaeologically visible by the green discoloration and/or copper residue. The archaeological data on this burial custom illustrates this; sometimes only small copper objects (i.e. wire) were documented, but more often the green discolorations, or copper residue were retrieved from archaeological context. The results of this study have also indicated that the most often occurring remnants of this burial custom were the green discolorations and the copper residue. For the majority of the individuals under study the presence of certain types of discolorations was an indicator for a funerary headdress. Though a pattern was observed for most of the individuals, this was also frequently only a partial pattern. Additionally, the funerary headdresses were not always reflected in the green discoloration, as for some of the crown individuals (almost) no green discoloration was present or the chemical data did not reflect the crowns properly; the 'invisible' crowns.

The difficulty in using the green discoloration as indicators for the presence of a funerary headdress is the possible remnants of other copper (alloy) objects. In the time period that this burial custom occurs most frequently, the general usage of copper (alloy) objects also increases. These can be either functional objects or decorative objects; the general usage of pins, buttons, and 'normal' jewellery was substantial in this time period. However, both the 'normal' copper objects and funerary headdresses leave areas of green discoloration. Though appearance of the green discoloration is reliable, results of this study have indicated that it is quite difficult to differentiate between these types of objects as well as to establish the presence of a funerary headdress solely based on the green discolorations. This can be illustrated with the individuals with find number 2366 (no crown) and 1927 (possible crown). The green discoloration for the latter individual, though in a pattern, was not very convincing. Additionally, no specific finds associated with a funerary headdress were documented. The pattern, however, indicated a possible presence of a funerary headdress, but it remains very difficult to establish this with certainty. The individual with find number 2366 was placed in group 4, as no funerary headdress was present. The two locations with green discoloration contained a high amount of Ag, but no correlation could be observed (discoloration on postcranial and skull regions). This individual was categorized with 'no funerary headdress

present'; but again this could not be definitely concluded. For both these individuals, the lack of additional finds or discolorations resulted in an uncertain determination; it may therefore be possible both individuals were not correctly identified.

Using a chemical analysis, the archaeological visibility of the funerary headdresses was only slightly improved. Though it was possible to establish some indicators for the presence of a funerary headdress as some had a distinct Cu value and the presence of Ag, these are not very reliable. The wide variety in Cu/Zn ratios complicates identifying certain objects; it was not possible to distinguish 'normal' copper objects from the funerary headdresses. In addition, the chemical composition of the analysed crowns did not always correspond with the discolorations; it was not possible to identify a funerary headdress based on the green discoloration. These variations and the difficulty in correlating the discoloration(s) on the skull with the analysed crowns can be either the result of selective leaching (of zinc) or the usage of a variety of objects in the crown (e.g. brass decorations). As these variations are also frequently present within one individual, it is quite difficult to identify a funerary headdress based on limited chemical data.

Conclusively, the archaeological visibility of a funerary headdress depends heavily on the aspects of preservation, construction and therefore local variation, and/or excavation methods. As these aspects, either combined or not, can influence the archaeological visibility in different ways, there is a huge variation in the archaeological visibility. Obviously, this has impact on how the funerary headdresses can be identified in archaeological context and therefore also the criteria and usage thereof.

Identification of the funerary headdresses: criteria and reliability

To assume a funerary headdress in archaeological context, this study has established several criteria. However, as the previously discussed variation is present in the archaeological visibility, these criteria should be used independently and simultaneously in order to prevent overlooking this burial custom. This can be illustrated with, for example, the individuals with find number 5830 and 3087; both very likely buried with a funerary headdress based on the criteria. However, the lack of green discoloration on the skull of find number 5830 implies that no funerary headdress was present; though the inorganic and organic finds documented for this individual were substantial. Therefore, the criteria for the green discoloration was not reliable; only the criteria established for the finds could be used. This was different for the individual with find number 3087, as a pattern was present in the discolorations and the only decorations documented for this individual were glass fragments; both the discoloration and finds criteria could be used. Of course, the previously discussed 'invisible' crowns for some of the crown individuals also illustrate the difficulty in using these criteria and identifying a funerary headdress. They should definitely be used as guidelines to indicate a funerary headdress in archaeological context. The variation in the archaeological visibility means that each crown can be reflected in the archaeological context in a different way; therefore the usage of these criteria as guidelines instead of absolute rules can definitely aid in assuming the presence of a funerary headdress. The established strong indicators are also very reliable, especially if it is possible to combine these, and should definitely be used. However, even with these reliable guidelines to identify a funerary headdress in archaeological context, it may not always be possible to definitely determine the presence of a funerary headdress in a grave.

Though the sample size was small, it was tested to analyse differences and similarities in data from the biological profile and presence-absence of a funerary headdress, as well as data from other archaeological examples and historical sources on this burial custom. Many aspects were discussed in this chapter, and though no definite conclusions can be made due to preservation, fragmentation, and general poor archaeological visibility, the next chapter will provide the conclusions of this study. Consequently, based on these conclusions on the archaeological visibility and the identification of funerary headdresses in archaeological context, recommendations regarding future analyses will also be established.

6. Conclusions and future recommendations

Based on the results and the subsequent discussion as presented earlier, the conclusions will be presented in this chapter. In addition the problems regarding the archaeological visibility of the funerary headdresses will also be shortly presented. With an overview of these problems, a few recommendations are made to overcome these problems for future analyses of this burial custom.

6.1 Summary & conclusions of this study

The material used in this study was a selection of the skeletal material excavated at the Plechelmusplein in Oldenzaal, the Netherlands. Though the material derives from the graveyard around the Plechelmus church which was in use from approximately 750 AD until 1829 AD, the skeletal material used in this study appears to be from the graves at least from 1500 AD on. For 15 individuals of the total 49 individuals under study, it was definite a specific burial custom named 'maiden crowns' was present; named 'funerary headdress' in this study. Generally, these funerary headdresses consisted of a metal crown-frame, decorated with different types of organic material (e.g. flowers, leaves, and paper) and were placed around the head of an individual. Based on their name, it would be expected that these crowns were mainly present in graves of unmarried, young (female) individuals. For the remaining 34 individuals under study the presence of this burial custom was not definitely established. To assume the presence of a funerary headdress for these individuals, the main goal of this study was to analyse and research the archaeological visibility and correlating identification of funerary headdresses in archaeological burial context. To establish specific criteria and indicators which can point to the presence of this burial custom, this study was divided into different aspects. The results of a physical anthropological analysis (for a biological profile), finds and crown analysis, and a chemical analysis were combined with current data on the funerary headdresses to research and to identify this burial custom in this study.

First, using both current archaeological and historical data on funerary headdresses, a general idea of how a funerary headdress was or may be constructed could be obtained; allowing for an overview on the (archaeological) expected material when this burial custom is indeed present (table 6.1). In addition, this also allowed for an overview on the current state of research on this burial custom. Though there were quite a few archaeological examples from the Netherlands, additional research and analyses were lacking; this resulted in a limited dataset on this burial custom in a local region. Furthermore, archaeological data on this burial custom were also obtained from examples excavated in Belgium; material and data from the United Kingdom,

Sweden, and Germany were also used. These were used to provide an overview of this burial custom in larger context (Europe), which also allowed for a general overview on expected material used in a funerary headdress as well as possible local or regional variation in this burial custom.

For most archaeological examples, the documented decorations indicated a crown made of normal copper wire or specifically Leonic wire (copper wire coated with silver or gold, originally fabricated in Lyon). Remnants of these crowns were observed around or near the head of an individual, though data from Germany also suggested that a crown, or a similar decoration, may be placed in/around the hands. As for further decoration of the crown, similar wires used in the frame were also used to create leaf and floral shaped ornaments and were entwined with the crown-frame. Several archaeological examples of a funerary headdress indicate the usage of organic material (e.g. paper or fabric) to create decorations which were placed on the crown; these ornaments were also frequently floral and leaf shaped objects. The current archaeological data on this burial custom also indicate the usage of other organic decorations (e.g. flowers and green herbs) and inorganic decorations (e.g. beads, sequins). Generally, these decoration(s) appear to be common as they were documented for most of the archaeological examples in Europe. The presence of small reflective material used as decorations (i.e. glass splinters) appears to be only present in the Netherlands and Belgium; this may be the result of local variation, or it may be possible this type of decoration was not documented for the other archaeological examples. Additionally, though the general decoration(s) were quite similar for most of the archaeological examples, it would seem that the type of decoration(s) used in the crown and their occurrence can vary; whether this is the result of local variation or poor archaeological visibility cannot be established with certainty.

Table 6.1: overview of expected material and decorations (inorganic and organic) for the funerary headdresses.

Inorganic	Organic
Leonic wires/Leonic flowers	Flowers (rosemary; roses)
Copper wires	Paper (ribbon/flower-object)
Iron wires	Silk (ribbon/flower-object)
Beads (glass)	Textile/fabric (ribbon/flower-object)
Smaller metal wires (fringes)	(green) Herbs
Leaf-flower objects of metal	Leaves
Glass (shreds/splinters)	
Pearls or imitation pearls	
Sequins	

Furthermore, the archaeological data from Germany illustrated that a funerary headdress may be present in different shapes and constructions; the most frequent occurring shapes were a cap, diadem, or a wreath-like element. Examples of funerary headdresses from the United Kingdom show a much different construction of the crown; frequently a bell-like object was placed on the coffin with similar decorations. Though the decorations can be similar, the type of construction indicates a regional variation of this burial custom may be present. However, for the archaeological data from the Netherlands, the most occurring shapes and constructions appear to be similar to what the archaeological data from Germany indicated; a crown or diadem-shaped object around/near the head of an individual.

On most aspects of this burial custom the historical data were correlated with the archaeological data. However, the historical sources also gave data on additional decorations which were not yet documented in the archaeological record (i.e. mostly organic material). Moreover, the historical sources illustrated other aspects which will never quite be visible in the archaeological record; aspects such as how and by whom the decorations were made or how the ritual was conducted. Again there appears to be variation between the types of decorations by region; for example the usage of glass was only mentioned for the regions of Brabant in the Netherlands. Overall, the historical data corresponded with the archaeological data, it did, however, also illustrate the possible poor archaeological visibility of a funerary headdress and therefore the difficulty in identifying this burial custom.

Archaeological visibility and identification of funerary headdresses

Using the expected material/decoration(s) in/of a funerary headdress based on archaeological and historical data, and the findings in this study, this study thus researched the archaeological visibility and identification of funerary headdresses in archaeological context. Identification and archaeological visibility are of course interrelated, as the archaeological visibility can affect the identification of this burial custom in archaeological context. In this study, the results of the material analysis and the chemical analysis for the 'crown' individuals were used in order to establish the archaeological visibility of this burial custom. Based on the artefacts and green discoloration(s) documented for these individuals, several criteria have been established to assume the presence of funerary headdresses in the material under study. In addition, the archaeological expected materials with this burial custom, as indicated by archaeological and historical data, were also used for these criteria. With these criteria as guidelines, the presence of a (probable) funerary headdress could be established; based on discolorations on bone, certain artefacts, and/or a chemical analysis, as well as a combination of these aspects.

The criteria consist of a series of indicatives; these are either strong indicatives (elements which directly can indicate the presence of a funerary headdress) or indicatives which should occur in combination(s) with (other) (strong) indicatives. The established criteria and associated indicatives were then applied on the material under study. However, the presence of a funerary headdress was not certain for all individuals, as there appears to be a huge variation in the presence and occurrence of specific indicatives, as well as the combinations thereof. The variation in these certain indicatives has brought insight into the variation of archaeological visibility of this burial custom and therefore also the difficulty in identifying this burial custom.

During this research it became clear that one of the main problems regarding the archaeological visibility of a funerary headdress is preservation. As previously mentioned, one of the frequently used decorations for a funerary headdress was organic material; material that does not always preserve well. This would imply that the inorganic material is often better preserved, though these finds were not substantial in this study. In addition, it became clear that these inorganic decorations may also be quite fragmented/different in appearance (i.e. fragmented Leonic flowers) or generally small in appearance (i.e. glass fragments), indicating that the excavation methods and additional research are also of importance and can influence the archaeological visibility. Besides preservation and fragmentation, the aspect of local variation was also addressed as an influence on the archaeological visibility (e.g. construction of the crown and type of decoration). Both the usage of different objects in the construction of the crown (e.g. brass wire instead of Leonic wires) as well as different decorations (e.g. the usage of reflective decorations) can result in a different interpretation or some 'invisibility' of this burial custom during excavation and further analyses.

However, though there is huge variation, and to some extend invisibility, the results of this study have indicated that the archaeological visibility of a funerary headdress is very likely to be limited to green discoloration(s) on certain areas of the skull and (small) fragments of both inorganic and organic material, but that these were separately also very difficult to use to assume the presence of a funerary headdress. Though frequently the only remnant, the presence of green discoloration alone was not always reliable to indicate a funerary headdress; lack of discoloration or pattern did not always indicate the absence of a funerary headdress. Moreover, the general usage of copper alloy objects in burial customs from this time period was sufficient, making it difficult to rely on the presence of green discoloration as well. In order to distinguish the 'normal' copper alloy objects from a funerary headdress, this study conducted a chemical analysis. Using the chemical data of the discoloration(s) on the individuals under study, two specific groups could be distinguished. The majority of the objects had Cu/Zn ratios similar to brass (probably functional objects); other measurements showed a higher amount of Cu and could therefore indicate jewellery. The chemical data of the fragmentary funerary headdresses also indicated a high amount of Cu, and the presence of silver (Ag) identified the usage of Leonic wires. The measurements on the correlated discoloration(s) for these crowns did, however, mostly fall in the brass ratio of Cu/Zn; indicating that there was a difference in the chemical composition between the crown and the remaining discoloration. This difference in Cu/Zn ratio in the crown and the remnant(s) on the skull may be the result of selective leaching (of Zn) or the usage of different types of objects in the crown. Even so, it did illustrate the difficulty in correlating the funerary headdress with the discoloration(s); but also the difficulty in identifying the funerary headdress solely based on chemical data.

In addition, the results of this study indicated that it was also not possible to rely on the finds criteria as well. Small, indeterminable inorganic finds were documented for several crown individuals; indicating that the preservation of even inorganic material cannot always sustain. Furthermore, for some crown individuals only one decoration was documented; no discoloration(s) were present or any indication in the chemical data corresponded with the presence of a funerary headdress. Conclusively, though criteria for discoloration(s) and finds were established, and to some extend for the chemical data, these criteria cannot completely be used independently due to the huge variation in preservation, fragmentation or local/regional interpretation of this burial custom.

Conclusions regarding burial custom and additional data

However, even with the difficulties, it was possible to identify the probable/possible funerary headdresses for the individuals under study using the criteria and additional data. Besides the crown individuals, 12 individuals were (very) probably buried with a funerary headdress; 5 individuals were documented as 'possible'. Besides using the finds/presence of discoloration(s)

for these individuals as additional data on the variation of archaeological visibility, these individuals were also further analysed. Additionally, the results of this study regarding presence/absence of a funerary headdress were placed in a larger context to research this burial custom; these findings were compared with the biological profile of an individual, but also with other data.

Though the frequently used term 'maiden crowns' implies a burial custom for young, unmarried females, historical data indicated that this burial custom is for "unmarried individuals, young or old". Comparing sex and age estimations with the presence or absence of a funerary headdress in this study indicated that sex differences were indeed not present. However, it can be concluded that, comparing absence-presence of a funerary headdress, age differences were somewhat present; young individuals appear to be frequently more documented with a funerary headdress than adults. However, comparing the age estimations of all the individuals with a funerary headdress, the amount of adult and young individuals seemed to be equal; indicating no age difference. As for the observed and documented patterns in the discolorations, it can be concluded that specific pattern types were possibly related to age and sex; the diadem pattern occurred more frequently in young individuals and females. The other documented pattern types occurred mostly in the adult individuals, but no sex difference could be observed. Therefore, even though the aspect of unmarried-married cannot be analysed from archaeological context and no definite conclusions can be made, the results of this study do correspond with the historical data; this burial custom was very likely for any unmarried individual, regardless of age and sex.

Comparing the results of this study with the archaeological and historical data on this burial custom resulted in some similarities and differences on other aspects. This study indicated that mostly a crown in a diadem shape is present (pattern type 1), as well as a wreath around/near the head (pattern type 2 and 3). The occurrence of the observed pattern types in this study was both mentioned in the archaeological and historical data, though the pattern types 2 and 3 were not discussed or observed in archaeological context until now. Furthermore, the results of this study and additional historical data were also similar on the aspect of possible postcranial locations for a funerary headdress; an aspect not discussed in the archaeological data for the Netherlands before.

The documented Leonic wires in this study (both based on chemical data as well as appearance) corresponded with the findings of Lippok (2013) for Germany, as well as the finds documented for Didam (the Netherlands). Though Leonic wires or generally copper wires were not specifically mentioned in any historical data, they were sufficient in the archaeological record and corresponded with the wires documented in this study. The presence of reflective

decoration for some individuals under study corresponded with the regions of Brabant (the Netherlands) and Belgium, at least for this aspect of a funerary headdress; both with the archaeological data as well as the historical data. This may correlate this aspect of the funerary headdresses in Oldenzaal with these regions; it should, however, also be taken into account that for other archaeological examples (in the Netherlands) this type of decoration may have been overlooked as this study indicated that these decorations appear to have a poor archaeological visibility. Lastly, the decoration of organic material in the shape of a flower or a leaf was mentioned in the historical data and was also documented in the archaeological data, though less frequent due to preservation. This did, however, indicate that this is a common decoration for this burial custom. In this study, this type of decoration with a similar appearance was present, though it was only one with a distinguished shape. It may be possible that other, similar decorations were present but lack of archaeological visibility limited any conclusions. To summarize, the results of this study corresponded with both historical and archaeological data, though on different aspects; this indicated also that both types of data were needed to conduct a full analysis on this burial custom.

Conclusively, a selection of decorations used in the funerary headdresses of Oldenzaal can be compared with examples from the southern region of the Netherlands (as well as Belgium and Germany); indicating a similar burial custom for the Catholic regions nearby Oldenzaal. Additionally, the other types of decorations documented in this study were quite common, as they were present in examples from all over Europe; this would indicate that the funerary headdresses can be similar on some aspects (e.g. leaf/flower shaped objects) but that local variation/local interpretation of this burial custom does occur and should not be overlooked. Moreover, the findings of this study corresponded with the historical data, even though not on all aspects. This may also be the result of local variation or poor archaeological visibility for the funerary headdresses in Oldenzaal.

Contribution of this study

Even though the aforementioned conclusions have brought insight into different aspects of this burial custom and its visibility, this study has also contributed to other aspects. One of these aspects was the chemical analysis. As it was initially thought that a chemical analysis could identify a funerary headdress, the results of this study have indicated that this is not possible. Though the additional chemical data in this study could not be entirely used as expected, it has brought opportunities for future research. The aspect of selective leaching is one which may be researched further upon; this in order to establish its effect on the chemical visibility of a funerary headdress and chemically processes after burial. The chemical analysis may also provide for additional data on the possibility that various objects of copper alloy were used, an aspect which is of importance when analysing this burial custom. Moreover, the chemical data

can to some extend also aid in establishing the presence of a funerary headdress with more certainty. Though the chemical data of this study provided the first step towards a more detailed research on funerary headdresses, additional chemical data are preferred. For now, chemical data on funerary headdresses are only available for Germany and Oldenzaal, but additional chemical data on funerary headdresses may aid in identifying, analysing, and researching the various chemical compositions of decorations used in this burial custom. This will also allow researching to what extend a chemical analysis can be used to identify this burial custom, as to what additional aspects are needed to identify this burial custom with chemical data.

As already discussed in the previous chapter, the state of research on this burial custom was limited. This was not exactly known at the start of this study, but analysing both archaeological and historical data illustrated that this burial custom is not frequently documented or described. This study contributed the first detailed data on this burial custom for the Netherlands. In addition, the overview of both archaeological and historical data, in combination with the results of this study allows a basis for future research. This overview in combination with the results of this study have also provided at least some general criteria to identify this burial custom in archaeological context; in addition an overview of archaeologically expected material and (local) variation were presented. Moreover, this study has provided several possibilities to research this burial custom further. These criteria and overview of current knowledge on this burial custom may prevent overlooking this burial custom and provide possibilities for future research; which will be discussed in the next paragraph.

6.2 Recommendations (further) analyses on funerary headdresses

With the established archaeological visibility of the funerary headdresses and the correlating problems regarding identifying a funerary headdress in archaeological context, recommendations for both future archaeological excavations and further analyses on this burial custom can be made. These recommendations are only suggestions; however, they do, when followed, allow for additional data on this apparently frequent 'overlooked' burial custom. If such additional data are available, it may allow more intensive research on this burial custom, as well as full comparisons between regions and countries. However, besides recommendations on how this burial custom should be analysed, a few indicatives of when this burial can be expected in archaeological context are necessary.

As for time period, various sources have indicated that the usage of this burial custom occurs most frequently in the period of 1800-1900 (time period of 1700-2000 is also possible). Therefore, this burial custom can be expected during archaeological excavations/research on (Catholic) cemeteries and/or graves dating to these periods. Moreover, besides the archaeological visibility, this burial custom is possibly also often overlooked because of the assumption that a funerary headdress should be present with a 'young, female' individual. However, results of this study have indicated that this burial custom can be present in both graves of young individuals as well as adults from this time period, though the decoration and construction of the crown may be different and therefore affect archaeological visibility. Even so, with this possible variation in the construction of crowns and (general) age of an individual, no differentiation in excavation methods should be made based on the age estimation of the individual. This is the same for the sex estimation of the individual; though there was variation present, this study has indicated this burial custom was conducted for both females and males.

In addition, though the copper (alloy) objects are substantial in this time period, the presence of green discoloration should not be immediately associated with 'normal' objects before additional analysis is conducted. Moreover, the presence of green discoloration should be further examined. The established criteria for the green discoloration (preferably in combination with the finds criteria) may prevent overlooking this burial custom. Generally, applying these criteria (with possible exception of the chemical criteria) may aid in establishing a possible or probable presence of a funerary headdress. As a result, if a funerary headdress is (possible/probable) present, additional excavation methods should be applied in order to ensure maximum data retrieval on this burial custom. These additional excavation methods, as well as additional analyses, are presented in table 6.2 (sorted by preferability), but will be shortly discussed.

First of all, besides the initial documentation of the grave (e.g. location, artefacts), additional inventories and documentation regarding artefacts and locations of (green) discoloration should be made. With such additional detailed documentation, it is possible to reconstruction this burial custom and associate specific artefacts to certain regions; it is therefore possible to reconstruction certain objects and their location. Of course, careful excavation of each artefact and/or residue is also necessary in order to further analyse this burial custom (see *additional research*). If such extensive extraction of artefacts is not possible, at the very least soil samples of the grave should be taken.

Furthermore, to ensure maximum data retrieval on this burial custom, it is preferred that the soil from the grave should be sieved. This will allow retrieval of (possible) glass fragments or other types of reflective decorations, smaller organic residue and copper residue, as well as other possible (small) inorganic or organic decorations which may be overlooked during excavation. Sieving all soil from the grave is of course time-consuming, and such intensive analysis of this burial custom cannot always be conducted. Alternatively, sieving only the regions of the skull, pelvis, and thorax can also ensure retrieval of most material (possibly) present with this burial custom. The region of the skull has priority over all other aforementioned regions. Even so, if sieving the soil during the archaeological excavation is not an option, again soil samples of either the skull region or in combination with the aforementioned regions should be taken in order to further analyse this burial custom.

Cleaning of the human skeletal material should be avoided. A huge amount of both inorganic and organic material documented during this study was *in situ* present due to the soil still present on the bones. Small artefacts such as glass fragments were still attached to a bone because of the presence of soil; it will not remain *in situ* when the material is cleaned. Alternatively, the material can be partially cleaned with the exception of the skull and only if all residues are collected for further analysis. Note that in order to correlate artefacts with skeletal elements, collecting the residue should be either per region or per skeletal element(s). If, for whatever reason, the skeletal material should be thoroughly cleaned, the same method applies as for the partial cleaning.

Even though this study has indicated the contribution of additional analyses regarding research on this burial custom, such analyses may not always be possible. This is especially true for the chemical analysis; though the results contributed to the research on funerary headdresses, this additional analysis is not always accessible or possible. It is therefore only one of the preferred methods of additional research, but optional. However, the analyses of the artefacts and the discoloration, as well as the physical anthropological analysis should be at least conducted.

Table 6.2: overview of additional excavation methods and additional analysis (sorted by preferability) to ensure maximum data retrieval on the burial custom of funerary headdresses.

Archaeological excavation methods	Detailed documentation of grave	Detailed documentation of grave	General documentation of grave
	Careful excavation of artefacts/residue	Careful excavation of artefacts/residue	Soil samples
	Sieving soil (complete grave)	Sieving regions of skull, thorax, and pelvis	Sieving region of the skull or soil sample of this region
Cleaning/processing	No cleaning; analysis of soil/residue	Partial cleaning (no cleaning of the skull); save soil/residue for analysis per region/skeletal element(s)	Thorough cleaning; save soil/residue for analysis per region/skeletal element(s)
Additional research	Analysis of artefacts (e.g. crown elements, glass)	Analysis of artefacts (e.g. crown elements, glass)	Analysis of artefacts (e.g. crown elements, glass)
	Chemical analysis of discolorations		
	Physical anthropological analysis	Physical anthropological analysis	Physical anthropological analysis
	Analysis of discolorations/locations (patterns)	Analysis of discolorations/locations (patterns)	Analysis of discolorations/locations (patterns)

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List of tables & figures

Figures

Figure 1.1: topographical map of Oldenzaal, with the excavation area of the Plechelmusplein outlined in red. (Oude Rengerink, 2011, p. 60)	**12**
Figure 2.1: pins found in many graves from the Carmelite convent in Aalst (de Groote *et al.*, 2011, p. 146).	**23**
Figure 2.2: buttons excavated from various sites in Scotland (Cox, 1996, p. 53).	**23**
Figure 2.3: lace tags excavated from various sites in Scotland (Cox, 1996, p. 55).	**24**
Figure 2.4: wire rings and eyelets found in many graves from the Carmelite convent in Aalst (de Groote *et al.*, 2011, p. 148).	**25**
Figure 2.5: cuff link found in Paisley, Scotland (Cox, 1996, p. 53).	**25**
Figure 2.6: coat chain found in a grave from the Carmelite convent in Aalst (de Groote *et al.*, 2011, p. 149)	**25**
Figure 2.7: fragment of braided textile intertwined with copper threads, found in grave 1412 from the Carmelite convent in Aalst (de Groote *et al.* 2011, p. 156)	**27**
Figure 2.8: green discoloration from a coin on the posterior aspect of the mandible of a child (Hopkinson *et al.*, 2008, p. 13)	**27**
Figure 2.9: fragment with copper residue and organic material (Groen-Houchin, 2013, p. 4).	**31**
Figure 2.10: decoration and the residue on a skull (Sam *et al.*, 2005, p. 74).	**32**
Figure 2.11: decoration and the residue (textile) on the skull (Schabbink, 2013, p. 35).	**34**
Figure 2.12: reconstruction of the decoration on the skull (Schabbink, 2013, p. 37).	**34**
Figure 2.13: field photo of the individual found with a funerary headdress (Panhuysen, 2004, p. 6).	**35**
Figure 2.14: small decorative ornaments of glass found with a funerary headdress in burial context (Veeckman and Bellens, 2013)	**39**
Figure 2.15: small fragments of glass found with a funerary headdress in burial context (Veeckman and Bellens, 2013)	**38**
Figure 2.16: reconstruction of the decoration on the skull (Lippok, 2009, p. 118). View is from above; in the left upper corner is the forehead.	**39**
Figure 2.17: XRF results of decoration made with Leonic wire (Lippok, 2013, p. 181).	**41**
Figure 2.18a, b: left (a): Decoration of metal fringes and organic material. Right (b): close up (Lippok, 2013, p. 191).	**41**
Figure 2.19a, b: left (a): pearl, Leonic wire, and garnet ornament (Lippok, 2013, p. 197). Right (b): hollow glass bead used as decoration (Lippok, 2013, p. 199).	**42**
Figure 2.20: decorative sequin-like object (Lippok, 2013, p. 194).	**42**
Figure 2.21: an example of a *'Brautkrone'* placed in the hands instead of on the head (Neuer Schottenfriedhof) (Krause *et al.*, 2013).	**43**
Figure 2.22: '*Totenkrone*' from the online database of 'Staatliche Kunstsammlungen Dresden'. Inventory number B2290 (http://skd-online-collection.skd.museum/).	**44**
Figure 2.23a, b: left (a): Skull with remnants of a '*Totenkrone*', excavated in Ankum (Lau, 2011, photograph by Hegenbarth-Jüdes). Right (b): A '*Totenkrone*' found in the grave of a young female (Richter and Scheidemantel, 2013).	**44**
Figure 2.24: 'maiden garlands' hanging at Holy Trinity Church, Minsterley, Shropshire (Morris, 2003, p. 362).	**45**
Figure 2.25: map showing the distribution of 'maiden garlands' in England and Wales (Morris, 2003, p. 361).	**46**
Figure 2.26: decorations of funeral coronets from Linköping, Sweden (Tagesson, 2015, p. 29).	**47**

Figure 2.27: portrait of deceased child wearing a cap and a funerary headdress. Portrait is by J.J de Stomme, made in 1654 (Hirsch, 1921, p. 43).	**50**
Figure 2.28a, b: left (a): photograph of a deceased child (1906). Right (b): another photograph of a deceased child (1897) (Sliggers, 1998).	**52**
Figure 2.29: a photograph of a twin, deceased, decorated with a crown and flowers (Sliggers, 1998).	**53**
Figure 2.30: photograph of a deceased child with decorations, no date, located in Basel (Richter, 2010, p. 204).	**53**
Figure 3.1: overview of the excavated graves at the Plechelmusplein. The graves in red are the selected graves for this research.	**62**
Figure 3.2: example from the database, presenting an individual with linked data. Physical anthropological data is in the upper record (find number 899, etc.) and XRF/data on finds is in the record below.	**74**
Figure 3.3: example from the database, presenting linked data of the skeletal regions and the correlating skeletal elements, as well as the anatomical locations.	**76**
Figure 3.4: the interface of the search function in the database.	**78**
Figure 4.1: overview of the young individuals under study, sorted by the age categories child, juvenile, and young adult.	**89**
Figure 4.2: overview of all age categories represented in the individuals under study.	**90**
Figure 4.3: overview of the female and male (sex estimations) individuals under study.	**90**
Figure 4.4: green discoloration on both orbits and multiple areas on the frontal (left) as well as the right parietal (right) of the individual with find number 1694. Circular, round of shape; both small and large areas. Other skeletal elements with green discoloration not displayed	**94**
Figure 4.5a: green discoloration on the left orbit (left) and frontal (right) of the individual with find number 2243. Diffuse, large area.	**95**
Figure 4.5b: green discoloration on the left parietal of the individual with find number 2243. Concentrated, small area.	**95**
Figure 4.5c: green discoloration on the right parietal-temporal area of the individual with find number 2243. Diffuse, small area.	**95**
Figure 4.6: green discoloration on the frontal of the individual with find number 2009. Large, round area. Green discoloration on the left temporal not displayed.	**96**
Figure 4.7: green discoloration on the frontal of the individual with find number 6373. Note the oval-shaped green discoloration; rest is diffuse. Green discoloration on the left temporal not displayed.	**97**
Figure 4.8a, b, c: up-left (a): green discoloration on left temporal (individual 1260). Up-right (b): green discoloration on the right temporal (individual 1260). Down (c): green discoloration on the frontal-parietal transition (individual 1260). All are small, diffuse areas.	**98**
Figure 4.9a, b, c: green discoloration on top of the skull and both parietals of the individual with find number 1887. Up (a): sagittal suture; down-left (b): left parietal-temporal; down-right (c): right parietal-temporal. All are large, oval areas.	**99**
Figure 4.10: green discoloration on both parietals-temporals and on top of the skull of the individual with find number 1875. Left is the left temporal-parietal; middle is the sagittal suture; right is the right temporal-parietal. All are small, oval areas and diffuse.	**100**
Figure 4.11: green discoloration on both parietals (on sagittal suture) and the left orbit of individual with find number 1695. Left is the frontal; right-above the right parietal and right-down the left parietal. All areas are diffuse and large.	**100**
Figure 4.12a: green discoloration on both parietals (on sagittal suture) of the individual with find number 1927. Left is anterior, right is posterior. Small, concentrated, oval area.	**102**
Figure 4.12b: green discoloration on the occipital of the individual with find number 1927. Up is superior, down is inferior. Small, round area.	**102**

Figure 4.13a: green discoloration on the occipital of the individual with find number 1377. Up is superior, down is inferior. Area is a large oval, almost rectangular.	**103**
Figure 4.13b: green discoloration on right temporal of the individual with find number 1377. Small, concentrated, round area.	**103**
Figure 4.14: green discoloration on the frontal (right), parietals (middle) and occipital (left) for the individual with find number 3797. Small, diffuse areas; some areas are concentrated.	**104**
Figure 4.15a, b, c: first row (a): green discoloration on parietal/sagittal suture; left is ectocranial, right is endocranial (individual 6786). Middle row (b): green discoloration frontal; left is ectocranial, right is endocranial (individual 6786). Last row (c): green discoloration on right orbit; left is ectocranial, right is endocranial (individual 6786). All areas are large and diffuse.	**105**
Figure 4.16: green discoloration on the posterior aspect of the mandible (individual 2243).	**107**
Figure 4.17: green discoloration on the posterior aspect of the mandible (individual 2403).	**107**
Figure 4.18: green discoloration on the right occipital-parietal (individual 5830). Large, diffuse area.	**109**
Figure 4.19: metal element #1 found in the skeletal area of the skull for the individual with find number 5917. Inset is a detailed photograph to illustrate this decorative metal element.	**111**
Figure 4.20: metal element #2 found in the skeletal area of the skull for the individual with find number 5917.	**112**
Figure 4.21: metal element #3 found in the skeletal area of the skull for the individual with find number 5917.	**112**
Figure 4.22: find #1 of copper residue in combination with organic residue (individual 5830).	**113**
Figure 4.23: find #2 copper ring containing organic residue (individual 5830).	**114**
Figure 4.24: find #2 copper ring containing organic residue (individual 5830).	**114**
Figure 4.25a, b: find #2 from individual with find number 5830. Up (a): microCT scan of the copper ring from figure 4.18-4.19, view is from above. Down (b): microCT scan of the same copper ring; view is from the side. Note the layering of a wire to form a ring. In both images, blue is organic material and orange is copper.	**115**
Figure 4.26: iron residue between the orbits, on the forehead (individual 1694).Note the nearby green discoloration of the skull.	**116**
Figure 4.27: iron residue located on the left parietal-temporal transition (individual 1875). Displayed is only the parietal; the iron residue is located inferiorly.	**116**
Figure 4.28: iron residue located on the right temporal (individual 1875) It is located anteriorly of the temporal, and shape like half a circle. Note the nearby green discoloration on the parietal.	**117**
Figure 4.29: red glass fragment on right parietal-occipital (individual 5830).	**118**
Figure 4.30: light-blue glass fragment on right parietal-occipital (individual 5830).	**118**
Figure 4.31: red glass fragment on right parietal-occipital (individual 5830).	**119**
Figure 4.32: white/transparent glass fragment on right parietal-occipital (individual 5830).	**119**
Figure 4.33: left maxilla with three glass fragments in situ (individual 3087). Numbers in this figure correspond with the numbers in the figures below.	**120**
Figure 4.34: red glass fragment on left maxilla (individual 3087).	**120**
Figure 4.35: green-blue glass fragment on left maxilla (individual 3087).	**120**
Figure 4.36: green glass fragment on left maxilla (individual 3087).	**121**
Figure 4.37: glass fragments (individual 3797).	**121**
Figure 4.38: organic residue found in the skeletal area of the skull for the individual with find number 5830.	**122**
Figure 4.39: organic residue located on the right temporal (superiorly) of the individual with find number 4453.	**123**
Figure 4.40: organic residue, probably hair, found in the skeletal area of the skull for the individual with find number 3797.	**123**
Figure 4.41a, b: left (a): Right scapula with green discoloration (individual 1694). Right (b): right clavicle with green discoloration (individual 1694).	**125**

Figure 4.42: left first rib (individual 1694) with green discoloration on the shaft, near sternal end.	**125**
Figure 4.43: metal fragment found on the thoracic vertebrae (individual 5830); located right inferior-lateral.	**128**
Figure 4.44a, b: left (a): left ulna with green discoloration on the shaft (individual 899). Right (b): right radius with green discoloration on the distal end (individual 1831).	**131**
Figure 4.45: left radius and ulna (6205.1) with green discoloration on their articular surface.	**131**
Figure 4.46a, b: left (a): left ulna with green discoloration (individual 5830). Right (b): right radius with green discoloration (and organic residue, see finds) (individual 5830).	**132**
Figure 4.47a, b: left (a): anterior view of humerus, with iron reside (individual 2366). Right (b): posterior view of humerus, with iron residue (individual 2366).	**134**
Figure 4.48: anterior view of the left humerus, on the distal end (encircled) organic residue was documented (individual 5830). See figure 4.49a for a detailed view.	**134**
Figure 4.49a, b: up (a): left distal humerus (individual 5830) with organic residue (same as in fig. 4.48). Note the dark-red as well as the brown colored organic residue. Down (b): right proximal radius (individual 5830) with organic residue. Note only the dark-red organic residue.	**135**
Figure 4.50: organic residue found by the right radius (individual 5830). Note the copper residue (left) and the brown colored organic residue (down).	**136**
Figure 4.51: left first metacarpal (left) and right second, fourth, fifth metacarpal, and right lunate with green discoloration (individual 1694).	**139**
Figure 4.52a, b: left (a): left ilium with green discoloration on the iliac fossa (individual 1205). Right (b): right ilium with green discoloration on the iliac fossa (individual 2009).	**141**
Figure 4.53: right ilium, posterior aspect with green discoloration and organic residue (left is proximal; right is distal) (5830).	**141**
Figure 4.54 organic residue on the posterior aspect of the ilium (individual 5830).	**143**
Figure 4.55: close up of fig. 4.54; zoomed in on the dark-red organic residue (individual 5830).	**144**
Figure 4.56: fragments of organic residue, found in the skeletal region of the pelvis (individual 5830). Note the dark-red organic residue (up and right) and the brown coloured organic residue (down-left). Copper residue is also present.	**144**
Figure 4.57: glass fragment on the left auricular surface (individual 5830).	**145**
Figure 4.58a, b: left (a): left and right tibia, lateral view (individual 6205.1). Right (b): left and right tibia, medial view (individual 6205.1).	**147**
Figure 4.59: glass fragment on the right tibial shaft of the individual with find number 6451.	**148**
Figure 4.60: same glass fragment as in fig. 4.54; close up (individual 6451). Note the smaller glass fragments underneath this fragment, left-bottom of the large fragment.	**149**
Figure 4.61: another glass fragment on the tibial shaft of the individual with find number 6451.	**149**
Figure 4.62: another glass fragment on the tibial shaft of the individual with find number 6451.	**150**
Figure 4.63: another glass fragment on the tibial shaft of the individual with find number 6451.	**150**
Figure 4.64 glass fragments documented without a skeletal category (individual 6451).	**152**
Figure 4.65: decorations documented for the individual with find number 5931 (crown number 5919). Note the entwined aspect of the wires, as well as the zig-zag pattern (Nooijen, 2016, p.139).	**155**
Figure 4.66: other decorations documented for the individual with find number 5931 (crown number 5919) (Nooijen, 2016, p.139).	**155**
Figure 4.67a, b: left (a): decorations documented for the individual with find number 5917 (crown number 5918). Zig-zag wire also containing a piece of fabric (Nooijen, 2016, p.139). Right (b): also a decoration documented for the individual with find number 5917 (crown number 5918). This element consists of some wires (spiral-shaped) and sequins (Nooijen, 2016, p.128).	**156**

Figure 4.68a, b: left (a): decoration documented for the individual with find number 6589 (crown number 6591); parallel wires entwined by another wire (Nooijen, 2016, p.139). Right (b): decoration documented for the individual with find number 6211 (crown number 6271). This element appears to be formed by entwined wire in large loops (Nooijen, 2016, p.139). **157**

Figure 4.69: decoration (Leonic flower) documented for the individual with find number 6749 (crown number 6748). Note the flower-shaped aspect formed by entwined wire and loops of wire (Nooijen, 2016, p.140). **158**

Figure 5.1: scatter plot of Cu/Zn ratios on the skulls and postcranial locations (crown individuals). The black line indicates the 1:3 ratio; measurements around this line belong to the brass group. **177**

Figure 5.2: scatter plot of Cu/Zn ratios on the skull (crown individuals); sorted/selected by skull region. **185**

Figure 5.3: scatter plot of Cu/Zn ratios taken on the skull (crown individuals); sorted/selected by patterns. **187**

Figure 5.4: scatter plot of Cu/Zn ratios on the skull and postcranial bones (crown individuals); sorted/selected by age category. **189**

Figure 5.5: location of the graves under study. Green= graves from group 1, 2, and 3 (with a funerary headdress), red= graves from group 4 and 5 (with no funerary headdress). **218**

Figure 5.6: location of the graves under study. Black= graves from group 1 (excluded), green= graves from group 2 and 3 (with a funerary headdress), red= graves from group 4 and 5 (with no funerary headdress). **219**

Figure 5.7a, b, and c: distribution of the younger age categories between the established groups. Up-left (a): age category child (Ch); 100% = 11 individuals. Up-right (b): age category juvenile (J); 100% = 5 individuals. Down (c): age category young adult (YA) 100% = 6 individuals. Total number of young individuals for all groups = 22. **221**

Figure 5.8: distribution of the adult individuals between the established groups; 100% = 27 individuals. **222**

Figure 5.9: distribution of the adult (A) and young (Y) individuals in the established groups. **222**

Figure 5.10: scatter plot of Cu/Zn ratios taken on the complete dataset. **229**

Figure 5.11: scatter plot of Cu/Zn ratios on the skull and postcranial bones; sorted/selected by age category. **230**

Figure 5.12: scatter plot of Cu/Zn ratios on the skull and postcranial bones; sorted/selected by sex category. **231**

Figure 5.13: scatter plot of Cu/Zn ratios on the skull and postcranial bones; sorted/selected by group. **232**

Figure 5.14: scatter plot of Cu/Zn ratios on the skull; sorted/selected by patterns. **233**

Figure 5.15: scatter plot of Cu/Zn ratios on the postcranial bones; sorted/selected by body region. **234**

Figure 5.16: scatter plot of Cu/Zn ratios on the manubrium for the individual with find number 1887 and manubrium-ribs for the individual with find number 1875. **236**

Figure 5.17: scatter plot of Cu/Zn ratios on the skull; sorted/selected by skull region. **237**

Tables

Table 2.1: copper alloy objects found in post-medieval burials and their correlating possible location on the deceased.	**28**
Table 2.2: overview of the discussed archaeological examples of funerary headdresses, including period/date and finds.	**58**
Table 2.3: overview of expected material and decorations (inorganic and organic) for the funerary headdresses.	**59**
Table 3.1: overview of selected find numbers used for this research. Age and sex category are preliminary; these are field determinations.	**63**
Table 3.2: overview of the pelvic traits used for sex assessment.	**66**
Table 3.3: overview of the skull traits used for sex assessment.	**67**
Table 3.4: overview of the body regions and the associated skeletal elements.	**71**
Table 3.5: used abbreviations in the database.	**77**
Table 4.1: overview of the physical anthropological data for the (probable) male category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**82**
Table 4.2: overview of the physical anthropological data for the (probable) female category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**84**
Table 4.3: overview of the physical anthropological data for the child and juvenile category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates.	**86**
Table 4.4: overview of the physical anthropological data for the young adult category. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**87**
Table 4.5: overview of the physical anthropological data for the individuals with a crown number. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; degree pelvis/skull= sexualization degree; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**88**
Table 4.6: overview of the skull regions and the total number of individuals which could be inspected.	**92**
Table 4.7: overview of the individuals with pattern frontal/forehead and parietals area.	**94**
Table 4.8: overview of the individuals with a pattern on top of the skull and parietals area.	**97**
Table 4.9: overview of the individuals with a pattern on the occipital and parietals area.	**101**
Table 4.10: overview of the individuals with a pattern on the frontal, parietals, and occipital.	**104**
Table 4.11: overview of the individuals with discolorations in the area of the mouth.	**106**
Table 4.12: overview of the individuals with no specific pattern of green discoloration.	**108**
Table 4.13: overview of the individuals with only one location of green discoloration.	**110**
Table 4.14: overview of the individuals with blue discoloration.	**111**
Table 4.15: overview of the torso and shoulder regions and the total number of individuals which could be inspected.	**124**
Table 4.16: overview of the individuals with discolorations on the torso and shoulder girdle.	**127**
Table 4.17: overview of the upper limbs and the total number of individuals which could be inspected.	**130**

Table 4.18: overview of the individuals with discolorations on the upper limbs.	**132**
Table 4.19: overview of the finds on the upper limbs.	**133**
Table 4.20: overview of the hand region and the total number of individuals which could be inspected.	**138**
Table 4.21: overview of the pelvic region and the total number of individuals which could be inspected.	**140**
Table 4.22: overview of the individuals with green discoloration on the pelvic girdle.	**142**
Table 4.23: overview of the lower limbs and feet and the total number of individuals which could be inspected.	**146**
Table 4.24: overview of the individuals with discolorations on the lower limbs.	**147**
Table 4.25: overview of the all XRF measurements, sorted by object/discoloration(s) and baseline/blanks measurements.	**159**
Table 5.1: overview of the crown individuals documented in this study, with physical anthropological data. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**162**
Table 5.2: overview of the crown individuals documented in this study, with skull and postcranial zones. Green (G) areas indicate green discoloration; blue (B) areas indicate blue discoloration; the grey areas (-) indicate zone was inspected but no discoloration documented; light-red (M) areas indicate zone was missing. "F" indicates a documented find for that zone.	**163**
Table 5.3: overview of expected decorations with a funerary headdress, based on documented finds for the crown individuals and archaeological/historical data.	**167**
Table 5.4: overview of the individuals documented with a pattern type, as well as the areas containing green discoloration(s).	**172**
Table 5.5: overview of the discussed pattern numbers and the corresponding discoloration(s) on skull areas, as well as the appointed type.	**173**
Table 5.6: overview of the individuals with discoloration(s) containing a high amount of Cu.	**179**
Table 5.7: strong indicators and other indicators (decorations and residue) of a funerary headdress.	**190**
Table 5.8: overview of the individuals and the physical anthropological data in group 1. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**195**
Table 5.9: overview of the individuals in group 1 with a pattern and their corresponding crown type.	**196**
Table 5.10: overview of the individuals with physical anthropological data in group 1; ordered by probability on the presence of a funerary headdress. Green= very probable, light-green= probable, very light-green= possible. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**204**
Table 5.11: overview of the individuals and the physical anthropological data in group 2. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**206**
Table 5.12: overview of the individuals and the physical anthropological data in group 3. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**208**
Table 5.13: individuals in group 4 documented with only one location of green discoloration.	**210**
Table 5.14: individuals in group 4 documented with only multiple locations of green discoloration.	**211**
Table 5.15: individuals in group 4 documented with multiple locations of green discoloration, both on the skull and on postcranial regions.	**212**
Table 5.16: overview of the individuals and the physical anthropological data in group 4. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**213**

Table 5.17: overview of the individuals and the physical anthropological data in group 5. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**214**
Table 5.18: overview of the young individuals with a pattern and the physical anthropological data; from group 1. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**223**
Table 5.19: overview of the adult individuals with a pattern and their physical anthropological data; from group 1. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**223**
Table 5.20: overview of the individuals with a pattern and the physical anthropological data; from group 3. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**224**
Table 5.21: overview of the individuals with a pattern and the physical anthropological data; from group 3. Individuals are sorted by pattern number and sex estimation. Vnr= find number; krn_nr= crown number; agecat= age category; sex= final estimated sex category; age min/max= minimal and maximal age estimates; AMstat= ante-mortem stature and standard deviation in centimeters.	**226**
Table 5.22: overview of the various decorations of a funerary headdress (first column) and their presence (first row) in Oldenzaal and previously discussed archaeological sites, as well as historical data.	**242**
Table 6.1: overview of expected material and decorations (inorganic and organic) for the funerary headdresses.	**257**
Table 6.2: overview of additional excavation methods and additional analysis (sorted by preferability) to ensure maximum data retrieval on the burial custom of funerary headdresses.	**266**

Appendixes

Appendix I: Catalogue Physical Anthropological Reports. Overview of each individual under study, including osteological data (e.g. age and sex estimation, pathological remarks) and the results of the chemical data for each XRF measurement taken.

List of abbrevations used in this appendix:

OA	osteoarthritis
DDD	degenerative disc disease (vertebrae)
DISH	diffuse idiopathic skeletal hyperostosis
CEJ	cemento-enamel junction
FAO	flowing anterior ossification
POA	peripheral osteoarthritis
TMJ	temporomandibular joint
VOA	vertebral osteoarthritis

During analysis and documentation of the location(s) with (green) discolorations, several abbrevations were used. List of used abbrevations for skeletal elements:

Acet	acetabulum
C/T/L/S (vertebrae)	cervical / thoracic / lumbar / sacrum
Dist ph	distal phalange
Fem/Fe	femur
Fib	fibula
Front	frontal
Hum/Hu	humerus
Int ph	intermediate phalange
Mand	mandible
Mast	mastoid
MC / MT	metacarpals / metatarsals
Occ	occipital
Par	parietal
Proc	process (e.g. zygomatic process)
Prox ph	proximal phalange
Sag.sut	sagittal suture
Temp	yemporal
Tib	tibia
Vert	vertebra(e)

Abbrevations for the dental analysis:

1+ / 1 / etc	amount of molar attrition
A	apex (formation) / $A^{1/2}$ indicates apex formation for 50% complete; "C" indicates "complete"
C	carious lesions
Cr	crown (formation) / $Cr^{3/4}$ indicates root formation for 75% complete; "C" indicates "complete"
H	hypoplasia
P	periodontitis
R	root (formation) / $R^{3/4}$ indicates root formation for 75% complete; "C" indicates "complete"

Abbrevations used to indicate status for the dental elements:

A	ante-mortem loss
C	congenitally absent
I	inspected tooth
P	post-mortem loss
M	missing / fragment of jaw could not be analysed
U	unerupted

Instead of the FDI numbers, certain elements were indicated by left/right and type of tooth and position indicated by the number in sub/superscript. The LP_2 is for example the left second premolar in the lower jar; the RP^1 is the right first premolar in the upper jaw. The used abbrevations for the elements are:

C	canine
I	incisor
M	molar (e.g. M2 = second molar)
P	premolar

Abbrevations were also used to indicate certain locations and/or anatomical:

Ant	anterior
C	center
Dist	distal
Ecto	ectocranial
Endo	endocranial
Inf	inferior
L	left
Lat	lateral
Med	medial
Post	posterior
Prox	proximal
R	right
Sup	superior

Other abbrevations:

Frag	fragment
Indet	indeterminable
Sulf	sulfite

Appendix I: Catalogue Physical Anthropological Reports

899

OVERVIEW

Number:	899	/ Crown number:	none
Reference number:	899-V-M		
Photo ID:	1338-1364		
Level (put/vlak/spoor):	1/5/469		

SUMMARY

Sex development:	MALE
Age-at-death:	43,75 – 55,25 years ±2,5 years / used method: COMPLEX
Calculated stature:	171,3cm ± 3,27cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue below the right orbit, on the right-inferior part of the sphenoid, anterior on the L5 vertebral body and on the left ulna (distal-medial)
Pathological & remarks:	cortical defect clavicle on both sides, periostitis, DDD, ossification of tendons, button osteoma, abscess and fistula in maxilla, infection of pulp chamber

SKELETON STATUS

Present:

Right	General/Skull	Left
General: all long bones except the fibula - though distal and proximal ends are missing, 1st, 2nd and 5th rib; *Hand:* capitate, 2nd - 5th metacarpals, 2nd - 4th proximal phalanges; *Foot:* fragments of talus, calcaneus, cuboid and navicular.	Mostly intact skull, fragments of occipital absent 2 cervical vertebral bodies, all T (fragmentary) and L vertebrae, S1, right ilium with ischium and pubis (not complete), left ilium with ischium (fragmentary), fragments of scapula (lateral), both clavicles with absent lateral ends, superior side of the manubrium	*General:* all long bones – though distal and proximal ends are missing; *Hand:* hamate, scaphoid, 2nd and 5th metacarpals, 3rd - 5th proximal phalanges, 2nd and 4th intermediate phalanges; *Foot:* fragment of the calcaneus and talus, 1st - 4th metatarsals.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
P	A	I	A	I	I	I	I		I	I	I	P	I	A	A	P
		5														
													c			
A	A	P	P	P	I	I	I		I	I	I	I	I	A	P	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe dental wear is present, as for most of the teeth the dentine is visible. Pulpa is exposed on 11 (infection of pulp chamber), 13 and 23.
- A fistula and abscess is present at the location of 11.
- Calculus is present on the lingual side of the lower incisors and canines.

PATHOLOGICAL/REMARKS

- On the femora and tibiae periostitis is present on the medial surface. There is reactive new bone formation, which is local. On the femora this is sclerotic, whereas on the tibiae this is mixed.
- On both clavicles a cortical defect is present. On the right side this is more prominent than on the left side.
- Marginal osteophytes are present on the T6-T7 and the L2-L4. On C6-C7, T7-T11 and all lumbar vertebrae are Schmorl's nodes present. With these indications, DDD is present on C6-C7 and the T7. Vertebral osteoarthritis is present on T4-T5.
- On the left side some ossification of the tendons is present, and on the right side both the interosseous crests on the radius and ulna are more prominent.
- There are two button osteomas on the frontal bone, on the forehead.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +1. In total 47,3% of the pelvis could be scored, of which the pre-auricular sulcus, greater sciatic notch and the ischial body were among the scored traits.
- The sexualization degree of the cranium is +0,54. The skull could be scored on all traits. This was the same for the mandible, though the sexualization degree is +1. In total the skull has a sexualization degree of +0,65.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the pubic symphysis and the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase IV and the spongiosa in the proximal end of the femur was in phase II. The spongiosa in the proximal end of the humerus was in phase II/III, which was the same for the pubic symphysis. Because both the humerus as well as the pubic symphysis were both between phases the final age assessment is a larger age range.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase IV/V (age-at-death: 35-45).

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. The length of the left femur was used in both methods. With Breitinger, this resulted in a stature of 168,1cm with a standard deviation of 5,40cm. With the method from Trotter & Gleser this was 171,3cm with a standard deviation of 3,27cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1513	**899**	zygomatic R	green residue	29	20	1,59	0,044	6,52	0,027	0,114	1,21	42	63	0,374
1514	**899**	temporal L	green residue	31	20	1,38	0,047	7,58	0,063	0,171	1,35	39	63	0,266
1515	**899**	temporal L	extra meting green residue	33	25	1,4	0,052	9,39	0,052	0,161	2,47	28	57	0,284
1516	**899**	parietal R	achtergrond meting	37	23	1,3	0,227	19	0,145	0,329	4,62	15	50	0,377
2446	**899**	L5	green residue	32	26	2,20	0,045	9,05	0,024	0,122	1,75	29	53	0,722
2447	**899**	L5	achtergrond meting	30	23	2,15	0,102	21	0,175	0,339	4,25	20	54	0,249
3476	**899**	ulna L	green residue	36	28	0,542	0,037	3,78	0,021	0,055	1,25	31	55	0,545
3477	**899**	ulna L	achtergrond meting	40	25	2,23	0,123	19	0,154	0,335	5,73	7,56	46	0,267

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1513	391	17978	17072	3113	219	237	124	1,84	22	1,76	64	35	92	35	55	54
1514	405	15199	2596	1718	189	213	152	2,2	30	2,57	26	33	101	33	66	41
1515	560	21038	4140	2075	196	224	138	3,38	30	1,58	32	39	84	39	51	33
1516	527	18069	73	493	260	293	94	2,08	24	1,57	59	36	81	36	55	46
2446	220	33271	51388	9847	447	376	121	1,84	24	2,44	111	35	62	35	31	45
2447	127	17751	72	790	505	294	118	20	79	2,72	61	54	63	54	32	43
3476	214	15503	22253	6874	170	63	123	1,84	21	315	46	1,5	3,57	39	37	71
3477	164	15276	28	468	109	68	199	1,84	22	332	36	1,5	3,87	37	41	61

912

OVERVIEW

Number:	912	/ Crown number:	none
Reference number:	912-V-VR		
Photo ID:	1785-1800		
Level (put/vlak/spoor):	2/1/6		

SUMMARY

Sex development:	FEMALE
Age-at-death:	25 - 34 years / used method: COMPLEX
Calculated stature:	157,84cm ± 3,72cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue above left orbit and on the left lateral side of the mandible
Pathological & remarks:	bilateral periostitis tibia, abscess and fistula in maxilla, bilateral prominent ulnar tuberosity

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: distal shaft of the humerus and trochlea, proximal end ulna, distal end radius, fragments of the femur, shafts of the tibia and fibula, 2 rib shafts; *Hand:* trapezoid,1st and 3rd metacarpals, 2 distal ends of metacarpals, 1 proximal phalange; *Foot:* -	Left orbit, left fragment of the maxilla, fragments of the left parietal and temporal, fragment of the right temporal, left side of the mandible, medial end of the right clavicle, left clavicle, C2 (dens), 8 T vertebral bodies, 3 C vertebral bodies, 16 fragments of neural arches, left ilium (fragmentary)	*General:* humerus, proximal ends of radius and ulna, femur, tibia, fragment of 1st rib, 3 rib heads, 1 rib shaft; *Hand:* hamate, scaphoid; *Foot:* fragments of the talus and calcaneus, 4th and 5th metatarsals, 1st proximal phalange.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	M	M	M	M	M	M	M		M	M	I	I	I	A	M	M
														3		
M	M	M	M	M	M	M	M		M	M	P	I	I	I	P	U/A?
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

– An abscess and fistula are present at the location of 26, where the fistula reaches into the maxillary sinus.

PATHOLOGICAL/REMARKS

- Periostitis is bilaterally present on the tibia. On the left tibia, this is on the lateral surface, with diffuse and sclerotic new bone formation. On the right tibia, this is on the medial surface, with also diffuse and sclerotic new bone formation.
- At the location of 26 (upper left first molar) is an abscess with fistula, which reaches into the maxillary sinus.
- The ulnar tuberosity is bilaterally more prominent, with some depressions, possibly related to the usage of the triceps.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -0,4. In total 52,63% of the pelvis could be scored.
- The sexualization degree of the cranium is -0,7. In total 52,63% of the cranium could be scored. The sexualization degree of the mandible is -0,125 and could be scored on all traits. In total the skull has a sexualization degree of -0,44 and in total 56,25% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the spongiosa in the proximal end of the femur and humerus. The humerus was in phase I and the femur in phase II. This gives an age-at-death at 25-34 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase IV-VI (age-at-death: 35-49), but based on dental attrition it would probably be closer to phase IV.

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser was used. The length of the femur was used with this method, which resulted in a stature of 157,84cm with a standard deviation of 3,72cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1642	912	mandible	green residue	27	17	2,59	0,040	9,18	0,064	0,219	1,98	42	64	0,557
1643	912	mandible	achtergrond meting	41	31	2,55	0,284	10	0,083	0,202	3,74	11	47	0,380
1644	912	orbit L	green residue	30	20	2,66	0,056	18	0,106	0,368	5,65	23	53	0,458
1645	912	orbit L	achtergrond meting	31	25	5,56	0,332	29	0,357	0,744	7,66	-0,865	41	0,339

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1642	167	13732	14269	4564	233	227	123	1,84	23	1,87	83	32	120	32	60	48
1643	126	27138	131	8324	268	325	141	2,42	24	2,74	90	30	117	30	60	50
1644	313	15303	16705	11728	168	254	128	1,84	22	1,50	69	33	98	33	46	29
1645	386	18402	2218	13837	313	331	138	5,94	26	2,87	76	25	152	25	54	32

1024

OVERVIEW

Number:	1024	/ Crown number:	none
Reference number:	1024-V-M		
Photo ID:	1591-1628		
Level (put/vlak/spoor):	2/2/19		

SUMMARY

Sex development:	MALE
Age-at-death:	57 years ± 3 years / used method: COMPLEX
Calculated stature:	170,6cm ± 3,27cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue on frontal/glabella, on the right frontal-sphenoid and on the right tibia
Pathological & remarks:	DISH, DISH related ossifications, chronic maxillary sinusitis, rotated LP_2, caries and enamel hypoplasia, spina bifida occulta (S1-S2), POA, spondylolisis, scoliosis, cortical defect, fracture ulna

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: all long bones, tibia and fibula have eroded proximal ends, 1st rib, 6 rib heads and 2 rib fragments; *Hand:* 2nd metacarpal; *Foot:* fragments of talus and calcaneus, medial cuneiform.	Most of the skull complete, left temporal and inferior part of the skull is missing, right clavicle, lateral side of the right scapula, all vertebrae, left side of the S1, right ilium and ischium, left ischium and fragments of ilium	*General:* proximal end of ulna, femoral head, distal shaft of the fibula; *Hand:* -; *Foot:* -

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
A	A	A	I	M	M	M	M		M	M	M	M	M	M	M	M
			h													
					c / h				c		h	h				c / 3
P	A	A	A	A	I	P	P		I	P	I	I	I	A	A	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Caries is present on the interproximal mesial surfaces of 31 and 43. It is also present on the lingual-distal surface of the 38.
- The 35 is rotated in the jaw, placed with the buccal surface mesially. Because of this, the dental wear is different (mostly on the original distal-occlusal surface, now buccally)

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location (and multiple hypoplasia lines) suggests there was a metabolic upset around the age of 3,6-4,2 years (left lower canine). Another hypoplasia line on the left lower canine was formed around the age of 5 years.
- Maxillary sinusitis is present on the right side (left is missing so not analysed). New bone formation is lamellae, diffuse and sclerotic.
- Ossification and fusion of the right vertebral bodies (T6-T11) are present, which indicates DISH. Furthermore, marginal osteophytes are present on the C6 (inferior) and C7 (superior), as well as on the T4 (inferior and superior) and T5 (superior). Vertebral osteoarthritis is present on the T1 (left), T11 (right) and the T12 (right). Some marginal osteophytes are present on the inferior articular facet of the C1 and the superior articular facet of the C2. The T9 and T10 show some indications for ossified connective tissues. Schmorl's nodes are present on all the vertebrae with DISH, but also the T12 and the inferior vertebral body of the L4. Spondylolisis is present on the L5 but has healed. Scoliosis is visible throughout the T1-T7. Also, the transverse foramina of the C7 are nearly completely fused.
- Peripheral osteoarthritis is present in the right clavicle-scapula joint (marginal osteophytes, erosion and eburnation is visible) and both hip joints (only marginal osteophytes and erosion). Marginal osteophytes are present in the right shoulder, elbow, wrist, ankle and foot joints.
- The right ulna has distally (approximately 3 cm above distal end) a healed fracture (callus present). The angulation and rotation of the fracture is both laterally.
- Periostitis is present on the medial surface of the right tibia. There is reactive new bone formation, which is diffuse and sclerotic.
- Enthesopathies: a cortical defect is present on the right clavicle. Furthermore, there is at several locations ossification present, which is in relation to DISH.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +0,09. In total 57,9% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,9. The skull could be scored on all traits. This was the same for the mandible, though the sexualization degree is +0,75. In total the skull has a sexualization degree of +0,875.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase IV. The spongiosa of the proximal femur was in phase III and the spongiosa of the proximal humerus was in phase IV. This gives an age-at-death at 57 years, with an age interval of 3 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase VII (age-at-death: 50-59).

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. With Breitinger, the measurement of the tibia (1b) was used, resulting in a stature of 170,14cm with a standard deviation of 4,7cm. Though the femur was in two fragments, its measurement could be taken and was used for the Trotter & Gleser method. This resulted in a stature of 170,6cm with a standard deviation of 3,27cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1517	1024	orbit L	green residue	35	29	1,76	0,048	3,44	0,005	0,062	1,43	29	55	1,01
1518	1024	temporal R	green residue	35	27	1,17	0,051	1,30	0,008	0,038	0,725	35	58	0,780
1519	1024	parietal R	achtergrond meting	28	18	2,50	0,460	7,35	0,065	0,218	1,02	43	65	0,247
5522	1024	tibia R med	green residue	36	28	2,11	0,224	11	0,078	0,182	3,15	19	51	0,484
5523	1024	tibia R lat	achtergrond meting	46	35	1,32	0,536	1,89	0,024	0,059	1,66	14	48	0,348

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1517	444	23925	19697	7496	648	291	155	1,84	22	1,50	185	26	85	26	51	37
1518	365	20498	16623	8699	610	281	87	1,84	22	1,65	194	31	77	31	50	32
1519	164	14681	58	462	218	236	116	1,84	23	2,22	57	34	133	34	68	42
5522	410	15971	14202	2986	262	54	169	2,35	23	408	91	1,5	5,78	27	52	61
5523	539	26586	24	569	190	35	180	1,84	23	383	56	1,5	5,47	29	54	43

1100

OVERVIEW

Number:	1100	/ Crown number:	none
Reference number:	1100-V-VR		
Photo ID:	1761-1773		
Level (put/vlak/spoor):	2/3/15		

SUMMARY

Sex development:	FEMALE
Age-at-death:	39,33 years ± 3 years / used method: COMPLEX
Calculated stature:	164,4cm ± 4,24cm / used method: Trotter & Gleser (radius)
Artefacts/crown/ residue on bone:	green residue on right maxilla and on the inside of the left temporal
Pathological & remarks:	series of cyst-like holes endocranially in the occipital, caries, abscesses and fistula in maxilla, maxillary sinusitis, marginal osteophytes in right and left shoulder joint, hyperostosis frontalis interna, VOA cervical and high thoracic vertebrae

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus (missing proximal end but head present), radius, ulna, femur (missing proximal end but head present),1st - 4th rib (fragmentary), 6th - 8th rib (fragmentary), 2 sternal rib ends, 1 rib head; *Hand:* scaphoid, 3rd metacarpal, 2 intermediate phalanges; *Foot:* -	Occipital, left parietal and temporal, fragments of the right parietal and temporal, zygomatics, maxilla, fragments of both orbits and frontal, both clavicles, lateral sides of both scapulae, superior part of the sternum body, C2 (dens), 3 C vertebral bodies, T4, T5, all T and L neural arches, spine of the sacrum, right ilium (fragmentary).	*General:* humerus, ulna, 3rd - 9th rib (fragmentary), 11th rib (fragmentary), 2 rib shafts, 1 rib head; *Hand:* capitate, 1st - 4th metacarpals, 1st - 3rd proximal phalanges; *Foot:* fragment of the talus.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	M	P	A	P	P	P	P		P	I	I	I	I	I	I	A
														3	3	
A	A	P	P	P	P	I	P		I	I	I	I	A	A	A	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Very severe dental wear: the mesial surface of the 22 is nearly gone. For all present teeth, the occlusal surfaces have also dental wear.
- Calculus is present on the labial side of the 31, 32, 42, 26 and 27.
- Of 24 and 25 only the root is present, because of caries. Caries is also present on the occlusal and lingual surface of the 38.
- Some discoloring is present on the 22 and 38.
- Both left lower premolars are double rooted.
- An abscess with fistula is present above 14, and only an abscess is present on 21 and 24-25.

PATHOLOGICAL/REMARKS

- On the left endocranial side of the occipital, multiple cyst-like holes are present. They are present just inferiorly of the transverse sulcus.
- On the left side there is maxillary sinusitis present. The new bone formation is spicule, local and woven.
- Marginal osteophytes are present in the right and left shoulder joint.
- Hyperostotis frontalis interna is present.
- VOA is present in the cervical and thoracic region. The superior articular facets of the C3 has some erosion. The inferior articular facets of the T3 and the superior articular facets of the T4 also have erosion. The T5 has on its right transverse facet some erosion.
- There is some inflammation on the right posterior side of the sacrum.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -1. In total 42,1% of the pelvis could be scored.
- The sexualization degree of the cranium is -0,8. In total 66,6% of the cranium could be scored. The sexualization degree of the mandible is -0,8 and could be scored on all traits. In total the skull has a sexualization degree of -0,83 and in total 75% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase II, whereas the phase for the spongiosa in the proximal end of the femur was in phase III. The spongiosa in the proximal end of the humerus was in phase III. This gives an age-at-death at 39,33 years with an age range of 3 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase VI and phase VII (age-at-death: 45-60).
- The sternal rib end could also be used, though identification of which sternal rib end was present was not possible due to fragmentation of all the ribs. The sternal rib end came close to phase V and VI (age-at-death: 35-55).

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser was used. The length of the radius was used with this method, which resulted in a stature of 164,4cm with a standard deviation of 4,24cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4659	1100	parietal L	green residue endo	36	28	1,06	0,128	3,75	0,026	0,057	0,833	30	57	0,237
4660	1100	parietal L	achtergrond meting	37	29	1,53	0,36	9,36	0,056	0,195	1,66	20	53	0,155
4662	1100	maxilla R	green residue	33	22	1,79	0,058	6,95	0,02	0,141	1,59	35	60	0,236
4663	1100	maxilla R	extra meting green residue	44	24	1,84	0,106	4	0,048	0,076	1,05	25	53	0,152
4664	1100	maxilla R	achtergrond meting	28	16	0,525	0,06	2,02	0,408	0,053	0,877	53	72	0,104

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4659	260	28456	15724	3772	69	65	206	1,84	22	180	36	1,63	8,27	45	58	78
4660	552	25931	81	487	178	68	132	1,84	23	276	46	2,16	5,34	38	54	62
4662	489	31624	8837	290	206	54	201	1,84	22	268	75	1,81	5,97	49	55	51
4663	345	20794	8626	303	148	47	127	1,84	23	291	55	3,73	5,38	37	52	47
4664	137	17553	47	210	66	71	192	1,84	23	182	18	2,46	6,44	62	79	185

1205

OVERVIEW

Number:	1205	/ Crown number:	none
Reference number:	1205-J-O		
Photo ID:	1426-1450		
Level (put/vlak/spoor):	2/5/46		

SUMMARY

Sex development:	INDETERMINABLE
Age-at-death:	14 - 19 years / used method: fusions axial/long bones/dental
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue on frontal and on the right orbit, as well as the left ilium (on the iliac fossa)
Pathological & remarks:	vitamin D deficiency, enamel hypoplasia, premolars with double roots

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humeral shaft, radius (unfused), ulnar shaft, femur (no proximal end and ephysis of head), tibia (with distal epiphysis and no proximal end), fibular shaft, 1st rib and 3rd rib (fragmentary), 3 rib heads and 2 rib fragments; *Hand:* -; *Foot:* fragment of calcaneus, medial cuneiform	Most of the right frontal, fragment of left orbit, zygomatics, parietals (fragmentary) and occipital (fragmentary), mandible and fragment of maxilla, both temporals, both clavicles, lateral sides of both scapulae, 2 sternal rib ends, 2 possible C vertebrae, all T vertebrae, 3 possible L vertebrae, the inferior parts of both ilia, and fragments of ischium; *Hand*: 1 metacarpal, 1 proximal phalange, 1 indeterminable; *Foot*: 3 metatarsal shafts.	*General:* fragment of the humeral shaft, distal radial shaft, femur (no proximal end and ephysis of head, distal ephysis), tibia (with distal epiphysis, no lateral-proximal side), fibular shaft, 1st rib (fragmentary); *Hand:* -; *Foot:* -

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
U	I	I	I	I	I	I	I		I	M	I	I	M	M	I	U
			c		h/c		h		h		h	c				
		h	h	h	h						h		h			
M	I	I	I	I	I	I	I		I	I	I	I	I	P	I	U
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Crypts for the M3 are already present in the upper jaw but not in the lower.
- Calculus is present on the 31 and 41.
- The lower incisors have dental wear on their occlusal surfaces, for the upper this is only the 11 and 21.
- 33, 24, 14 and 15 have all double roots instead of a single root.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location and presence of hypoplasia suggests there was a metabolic upset around the age of 4-5 years (upper incisors: 4,4-5,0 and upper canines: 4,3-4,8) but also earlier, probably at the age of 3 years (upper incisors: 2,9-3,4 and lower canines: 2,7-3,1).
- The lower limbs are bowed. Both femora are bent at their proximal ends and bent laterally. The tibiae are bent medially at the shafts, and the fibulae are bent anteriorly-posteriorly. Also, the humerus is slightly bowed. All these indicators point to a severe vitamin D deficiency. Even the right clavicle has been affected: with the elasticity of the bone because of the vitamin D deficiency, the medial end of the clavicle is very prominent.

SEX ASSESSMENT

- znot possible due to age, though the skull has some female traits (the glabella is smooth). The mandible, however, is broad.

SKELETAL AGE ASSESSMENT

- Dental eruption and mineralization could be used to assess an age-at-death, though the roots of the M3 which was present were eroded. In the upper jaw the crypts were present for the M3, this was not present in the lower jaw. The M2's have fully developed roots which indicates an age-at-death of 15 years (and an age range of ±36 months).
- As for closures and fusions of the axial and postcranial skeleton, a few indicators could be used. The basilar part to occipital bone had fused which would indicate an age older than 5 years. The acetabulum was fusing, indicating an age of 11-17 years. This could be narrowed down using the epiphyseal fusions of the postcranial skeleton. The proximal epiphysis of the femur was still fusing (age: 12-19) and the distal epiphysis of the tibia was already fused (age: older than 14). With these two indicators, the age-at-death range came to 14-19 years.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1646	1205	orbit R	green residue	28	22	2,36	0,096	10	0,039	0,175	2,75	34	58	1,18
1647	1205	orbit R	achtergrond meting	25	13	3,63	1,42	53	0,460	1,08	9,58	-6,263	41	0,378
1648	1205	pelvis	green residue	27	19	2,29	0,029	3,97	0,006	0,074	0,449	47	67	0,309
1649	1205	pelvis	extra meting green residue	30	21	2,63	0,027	4,06	0,010	0,074	0,725	42	64	0,322
1650	1205	pelvis	achtergrond meting	13	13	7,58	0,554	46	0,409	1,08	5,78	13	53	0,374

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1646	308	21862	25325	5013	793	280	80	1,84	22	1,50	245	23	89	23	46	43
1647	195	13020	241	517	336	368	152	8,62	36	2,38	93	24	123	24	54	37
1648	394	14231	10808	2709	210	289	193	1,84	26	2,05	38	39	116	39	61	59
1649	404	14020	7604	2625	209	303	177	1,84	30	2,78	45	47	122	47	59	51
1650	126	15694	210	923	491	293	207	16	73	2,75	107	29	183	29	62	52

1260

OVERVIEW

Number:	1260	/ Crown number:	none
Reference number:	1260-V-M		
Photo ID:	1811-1844		
Level (put/vlak/spoor):	2/5/42		

SUMMARY

Sex development:	MALE
Age-at-death:	45,33 years ± 3 years / used method: COMPLEX
Calculated stature:	162,85cm ± 4,05cm / used method: Trotter & Gleser (hum.)
Artefacts/crown/ residue on bone:	green residue present on the right sphenoid-temporal, on the left temporal and on the frontal-parietal (left)
Pathological & remarks:	multiple button osteoma on the frontal bone (9x), severe amount of calculus on the molars, slightly bowed lower limbs, caries (vitamin D deficiency), hyperostosis frontalis interna, enamel hypoplasia

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humerus (no medial epicondyle) proximal end radius, proximal end ulna (no head), femur (no distal end), patella, tibia (fragmentary proximal end), distal end fibula, sternal ends of 1st and 2nd rib, 2 rib shafts; *Hand:* proximal end of 5th metacarpal; *Foot:* fragment of tarsal, navicular, 3rd metatarsal, 1st proximal phalange	Most of the skull in fragments but complete, mandible, right frontal, right parietal, right temporal, fragment left temporal, occipital, posterior side of left parietal, zygomatics, maxilla (left incomplete), right clavicle (no medial or lateral end), lateral side right scapula, left sides of C1 and C2, C3-C5, right ilium (fragmentary), malleus.	*General:* distal end fibula, 4 rib shafts; *Hand:* 1st - 4th metacarpals, 3rd - 5th proximal phalanges; *Foot:* proximal end of 5th metatarsal.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
A	I	I	I	I	P	P	I		I	I	I	P	I	M	P	P
			c				h				p		c			
												p				3
P	A	I	I	P	I	I	P		I	P	I	I	P	A	P	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe amount of calculus on the molars, the dental wear and attrition could not be observed because of this.
- Also a severe amount of dental wear, affecting most of the canines and premolars. The upper teeth are more affected than the lower teeth.
- The mesial side of the 25 is not present anymore due to caries. Caries is also present on the distal interproximal surface of the 15.
- Periodontitis is present on the location of 23 and 34.
- Abscesses are present on the locations of 24, 28 and 38. Only at the location of 38 a fistula is also present.

PATHOLOGICAL/REMARKS

- Hyoplasia is present on at least one tooth. The location suggests there was a metabolic upset at the age of 3 years and at the age of 4 years.
- In total there are 3 abscesses, on the location of 24, 28 and 38. Only at the location of 38 there is a fistula present.
- On the frontal bone there are 9 button osteomas present. Some of them are ossified, some not. The largest one is larger than 1cm.
- Both the femur and tibia are slightly bowed. For the femur, this is proximal and it is bent laterally. The tibia is bent medially.
- Hyperostosis frontalis interna is present.

SEX ASSESSMENT

- Due to fragmentation, the WEA method could not be applied on the pelvis. However, the fragments indicate some rubusticity, and the pelvic inlet appears to be heart-shaped, both indicating possibly male.
- The sexualization degree of the cranium is +0,2. In total 87,5% of the cranium could be scored. The sexualization degree of the mandible is +0,37 and could be scored on all traits. In total the skull has a sexualization degree of +0,24 and in total 90,62% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase IV. The spongiosa in the femur was in phase II, the humerus was in phase III. This gives an age-at-death at 45,33 years with an age interval of 3 years.

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. It was only possible to use the total length of the humerus. With Breitinger, this resulted in a stature of 164,6cm with a standard deviation of 4,9cm. With the method from Trotter & Gleser this was 162,85cm with a standard deviation of 4,05cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2448	1260	frontal-parietal	green residue	34	22	1,43	0,084	21	0,209	0,296	3,48	17	50	0,327
2449	1260	frontal-parietal	extra meting green residue	37	27	1,65	0,095	13	0,072	0,207	3,84	18	50	0,337
2450	1260	frontal-parietal	achtergrond meting	49	37	0,154	0,056	3,24	0,032	0,057	0,946	9,68	46	0,216
2451	1260	temporal R	green residue	35	26	2,80	0,067	5,08	0,048	0,142	1,40	29	54	0,997
2452	1260	temporal R	achtergrond meting	38	26	2,43	0,424	12	0,109	0,260	2,35	19	52	0,194
2453	1260	temporal L	green residue	33	25	4,25	0,048	6,44	0,032	0,135	1,97	29	53	0,691
2454	1260	temporal L	achtergrond meting	40	25	2,23	0,196	25	0,208	0,449	6,40	0,380	42	0,375
2455	1260	temporal L frag	(past aan temporal L, green residue loopt door) green residue	39	31	2,61	0,031	6,95	0,058	0,089	2,45	18	50	0,433
2456	1260	temporal L frag	(past aan temporal L, green residue loopt door) extra meting green residue	40	32	3,15	0,039	4,19	0,048	0,060	1,24	19	49	0,561
2457	1260	temporal L frag	(past aan temporal L, green residue loopt door) achtergrond meting	54	43	0,235	0,011	5,57	0,061	0,114	2,50	-5,300	38	0,287
3478	1260	sphenoid R	green residue (suture)	40	30	1,28	0,121	4,52	0,04	0,105	1,3	22	52	0,303
3479	1260	sphenoid R	achtergrond meting op zygomatic	33	19	3,07	0,347	29	0,316	0,663	6,65	7,22	47	0,364

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2448	241	31380	11571	7929	118	288	143	1,84	21	1,50	44	41	55	41	35	53
2449	256	27008	13468	8439	140	315	204	1,84	21	1,50	54	40	57	40	35	51
2450	306	30082	4,10	228	15	256	211	1,84	21	1,50	4,45	38	29	38	35	71
2451	284	22779	25034	9513	343	317	119	1,84	21	1,50	158	45	64	45	29	44
2452	275	22372	111	834	159	298	119	3,34	21	1,75	66	56	67	56	32	45
2453	283	23387	46733	7820	348	407	118	1,84	21	3,10	144	35	81	35	31	43
2454	274	36808	106	1694	187	369	201	2,78	22	2,91	64	44	63	44	33	71
2455	245	26961	11237	7557	320	351	162	1,84	21	1,53	106	59	68	59	32	58
2456	362	31560	20735	8909	483	376	125	1,84	21	1,63	153	36	74	36	32	45
2457	779	35217	84	352	20	337	117	1,84	21	1,53	10	43	29	43	33	43
3478	360	22810	15406	4960	77	74	183	1,84	21	295	28	1,5	3,32	40	40	62
3479	124	12723	147	963	334	50	119	8	37	350	92	2	7,11	46	36	55

1333

OVERVIEW

Number:	1333	/ Crown number:	none
Reference number:	1333-V-VR		
Photo ID:	1845-1867		
Level (put/vlak/spoor):	2/6/58		

SUMMARY

Sex development:	FEMALE
Age-at-death:	54,67 years ± 3 years / used method: COMPLEX
Calculated stature:	157,17cm ± 3,55cm / used method: Trotter & Gleser (fe+tib)
Artefacts/crown/ residue on bone:	green residue is present on frontal
Pathological & remarks:	crowding of incisors and canines in maxilla, torus palatinus, caries, abscess in maxilla and mandible, enamel hypoplasia, diastema upper central incisors, calculus, marginal osteophytes and some eburnation in hip joints (no POA)

SKELETON STATUS

Absent:

Right	**General/Skull**	**Left**
General: proximal humeral shaft, proximal femoral shaft, proximal end fibula, midshaft of 1st rib; *Hand:* hamate, triquetral, pisiform, trapezoid, trapezium, 1st and 5th metacarpal; *Foot:* all proximal, intermediate and distal phalanges	Inferior part of cranium, fragments of both temporals, zygomatics, all of the scapulae expect the lateral sides, hyoid, C1, C2, S4-S5, coccyx, fragments of the right pubis.	*General:* humeral neck, shaft and distal end of ulna, radial shaft, patella, proximal end fibula, midshaft of 2nd rib; *Hand:* all carpals, 5th metacarpal; *Foot:* medial cuneiform, cuboid, all proximal (except 1st), intermediate and distal phalanges.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	M	M	P	P	I	I	I		I	I	I	P	P	M	M	M
					h						h			c	c / 4-	
C	P	P	P	P	I	I	I		I	I	I	I	I	I	I	C
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Calculus is present on the labial side of 13, 22, 42, 41, 31 and 32.
- Caries is present on the medial surface of 37 and completely on 36; resulting in the absence of the crown and the distal root of this element.

- The root of 23 is curved to the left instead of the right, placing its root towards the 22. Overall, in the area of the the upper incisors as well as the canines there is crowding; these elements are not aligned.
- An abscess is present at the locations of 23 and 36.
- Torus palatinus is present.

PATHOLOGICAL/REMARKS

- Hyoplasia is present on the lower canines. The locations suggests there was a metabolic upset at the age of 2,7 years and at the age of 3,6 years.
- Marginal osteophytes present on the left inferior facet of the T2. It is also present on the inferior right side of the T9 and the superior right side of the T10.
- Marginal osteophytes and erosion are present in both hip joints. The erosion is, however, not severe and there is therefore no indication for POA.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -0,68. The pelvis could be scored on all traits.
- The sexualization degree of the cranium is -0,09. In total 87,5% of the skull could be scored. The sexualization degree of the mandible is -0,25 and could be scored on all traits. In total the skull has a sexualization degree of -0,01 and 90,6% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the pubic symphysis and the spongiosa in the proximal end of the femur. The endocranial suture obliteration was in phase IV and the pubic symphysis was between phase III. The spongiosa in the proximal end of the femur was in phase III. This gives an age-at-death at 54,67 years with an age range of 3 years.
- With the Suchey-Brooks method, the pubic symphysis was in phase IV (26-70 years).
- The auricular surface could also be used for an age-at-death assessment. The age range was 30-34 years (phase III).

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser was used. The length of the femur was used with this method, which resulted in a stature of 157,17cm with a standard deviation of 3,55cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4665	1333	frontal R	green residue	37	29	2,63	0,021	6,42	0,036	0,058	2,08	23	52	0,416
4666	1333	parietals	achtergrond meting	30	21	4,25	0,507	35	0,314	0,767	6,94	1,26	44	0,249

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4665	165	22473	18914	2871	921	49	119	1,84	22	374	258	1,5	8,53	39	48	65
4666	140	19956	75	696	395	77	225	6,84	32	385	81	2,84	7,54	59	55	50

1377

OVERVIEW

Number:	1377	/ Crown number:	none
Reference number:	1377-V-VR		
Photo ID:	1295-1318		
Level (put/vlak/spoor):	2/7/65		

SUMMARY

Sex development:	FEMALE
Age-at-death:	51 – 60 years / used method: COMPLEX
Calculated stature:	155,12cm ± 3,72cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue on occipital, right temporal
Pathological & remarks:	right radius fracture, DDD on L5-S1, vitamin D deficiency, ossification of manubrium-sternum, TMJ osteoarthritis, POA in right hip joint, maxillary sinusitis, premolar with double roots

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: all long bones, though not complete, ribs 1-6, 8-9, 11 (heads with shaft) and 5 ribfragments; *Hand:* scaphoid, capitate, trapzoid, all metacarpals and all proximal phalanges; *Foot:* all metatarsals except the intermediate cuneiform.	Mandible, both temporals, fragments of the frontal and occipital, both parietals, right zygomatic-maxilla, fragment of left maxilla C1, C2 (dens), all T and L vertebrae (though fragmentary), right-lateral side of the sacrum, right and left ilium and ischium, both clavicles and scapulae (fragmentary) present, manubrium-sternum	*General:* all long bones, though not complete or fragmentary, ribs 1-7, 10 (heads with shaft) and 1 ribfragment; *Hand:* capitalum, 2nd - 5th metacarpals, 2nd - 5th proximal phalanges, 2nd and 3rd intermediate phalanges; *Foot:* talus, calcaneus, cuboid, 1st, 3rd and 4th metatarsals, 1st proximal phalange

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
A	A	A	A	I	P	A	A		A	A	I	A	A	A	A	A
A	A	A	A	A	P	A	A		A	A	P	A	A	A	A	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- No dental data present.

PATHOLOGICAL/REMARKS

- Vitamin D deficiency present, noticeable at the slightly bent tibiae (proximal ends).
- Marginal osteophytes are present on the S1 and the L5 vertebrae which indicate the presence of DDD.
- Erosion in the acetabulum and on the femoral head indicates some osteoarthritis in the right hip joint. This is also present in the jaw joint.
- The sternum and the manubrium have ossified, and the clavicle as an extra rib facet.
- The distal end of the right radius has had a fracture. It has healed, but is now slightly misaligned.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -0,4. In total 63,1% of the pelvis could be scored, of which the pre-auricular sulcus, greater sciatic notch and the ischial body were among the scored traits.
- The sexualization degree of the cranium is -0,6. The skull could be scored on all traits, except for the frontal inclination. The mandible could also be scored on all traits and has a sexualization degree of -0,25. In total the skull has a sexualization degree of -0,85.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the spongiosa in the proximal end of the femur and humerus. The spongiosa of the proximal femur was in phase III and the spongiosa of the proximal humerus was in phase IV (age-at-death: 51-60 years).

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser could be used. The length of the left femur was used in both methods. This resulted in a stature of 155,12cm with a standard deviation of 3,72cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1672	1377	occipital	green residue	34	28	1,78	0,040	2,42	0,013	0,054	0,860	33	57	0,556
1673	1377	occipital	achtergrond meting	21	13	3,12	0,329	57	0,431	1,18	8,30	-4,345	44	0,350
1674	1377	temporal R	green residue	32	19	1,24	0,021	4,09	0,011	0,053	0,556	43	62	0,356
1675	1377	temporal R	achtergrond meting	28	25	2,38	0,273	23	0,151	0,473	4,87	15	52	0,187
1693	1377	parietal L	green residue	29	22	2,78	0,050	7,49	0,057	0,174	1,72	37	59	0,891
1694	1377	parietal L	achtergrond meting	35	21	2,01	0,442	33	0,286	0,653	8,50	-0,228	43	0,422

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1672	339	18696	28924	6996	529	305	137	1,84	23	1,63	180	32	92	32	50	36
1673	71	11387	264	1152	474	309	83	13	47	3,34	114	25	112	25	52	29
1674	217	17651	19775	4495	255	262	113	1,84	24	3,53	76	42	106	42	73	42
1675	374	18581	154	1322	423	263	196	14	51	1,75	56	34	113	34	62	63
1693	419	16704	31431	5945	944	293	209	3,87	23	1,66	253	43	109	43	54	93
1694	152	16562	129	621	386	320	129	7,05	26	2,78	122	27	92	27	51	51

1694

OVERVIEW

Number:	1694	/ Crown number:	none
Reference number:	1694-V-M		
Photo ID:	1868-1899		
Level (put/vlak/spoor):	5/2/4		

SUMMARY

Sex development:	MALE
Age-at-death:	52 – 61 years / used method: COMPLEX
Calculated stature:	171,1cm ± 3,27cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue present on frontal and orbits, a concentration of iron residue on the forehead (between orbits), small concentrations of green residue on the left temporal, mandible, right parietal, right scapula and clavicle, left 1st rib, right lunate, right 2nd, 3rd and 4th metacarpals, 1st right metacarpal, on right femoral head, posterior side of right tibia (proximal and distal)
Pathological & remarks:	marginal osteophytes on T3, compression on T8 + L1, maxillary sinusitis, linea aspera not very visible, abscesses and fistula in maxilla and mandible, enamel hypoplasia, left os coxa more female traits – right os coxa more male traits, possible rib fracture, possible osteoporosis

SKELETON STATUS

Presence:

Right	General/Skull	Left
General: Humerus (no neck), radius, ulna, femur (missing medial epicondyle) tibia, fibula (no proximal and distal end), 1st rib shaft, 8 rib heads, 3 rib shaft fragments; *Hand:* hamate, lunate, 1st - 5th metacarpals, 1 proximal phalange, 2 intermediate phalanges; *Foot:* fragment of talus.	Fragments of frontal and right parietal, mandible, posterior side of left parietal, occipital, maxilla, zygomatics, right temporal, both clavicles, lateral sides of scapulae, manubrium and fragment sternum body, all vertebrae (eroded), S1 (fragmentary) – S3, right and left ilium (fragmentary), right and left ischium,	*General:* humerus (no neck), radius, ulna, femur, patella, tibia, 1st rib shaft, 10 rib heads, 2 rib fragments; *Hand:* lunate, 1st - 4th metacarpals, 1 proximal phalange, 1 intermediate phalange; *Foot:* fragment of calcaneus, navicular.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
P	I	I	I	I	I	I	P		P	I	I	P	P	A	P	P
	3+ / h / c	4 / h		c	c					c	h					
					h / c											
P	A	A	P	P	I	P	P		P	P	P	P	P	A	P	P
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe dental wear is present on most of the teeth, as is caries. The 22 and 14 have been damaged by caries, only the roots are present. There is a neck caries present on 13, which has caused a complete gap (mesial-distal surface). Furthermore, 17 has a caries on both interproximal surfaces, and the 43 has also a neck caries.
- Abscesses are present on the locations 14, 12, 24, 25 and 34. Only at the location of 34 there is also a fistula present.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests a metabolic upset between the ages of 2 and 5 years.
- In total 4 abscesses are present, of which one covers both 24 and 25. A fistula is only present in the mandible, at the location of 34.
- Maxillary sinusitis is present in the left sinus. The new bone formation is lamellae and spiculae, and is diffuse.
- The traits on the left side of the pelvis indicate female, whereas the right side indicate male. For example, the arc composé is -1 on the left side, +1 on the right side. Furthermore, the sacro-iliac joint is more degenerated on the left side than on the right side. The linea aspera on the femur is also not very prominent.
- Some marginal osteophytes are visible on the T3 and the L5. The T8 and the L1 show some slight compression, the vertebral body of the T8 also consist of trabecular bone with a lot of open spaces, which might indicate osteoporosis.
- There might be a possible rib fracture. However, the fragment on which this is visible is quite small and it is indeterminable which exact rib it is.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +0,26. In total 78,94% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,9. In total 90,47% of the cranium could be scored. The sexualization degree of the mandible is +0,125 and could be scored on all traits. In total the skull has a sexualization degree of +0,69 and in total 90,62% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the femur. The endocranial suture obliteration was in phase IV. The spongiosa in the proximal end of the femur was in phase III. This gives an age-at-death between 52 and 61 years.
- The auricular surface could also be used for an age-at-death assessment. The age range was 40-49 years (phase VI). However, the auricular surface of the left side was considerably more degenerated than the right side, so no definite age range can be made based on this method.

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. The length of the femur was used with both methods. With Breitinger, this resulted in a stature of 170,1cm with a standard deviation of 5,4cm. With the method from Trotter & Gleser this was 171,1cm with a standard deviation of 3,27cm.

DESCRIPTION ARTEFACTS

- The amount of green residue all over the skull and the postcranial bones is remarkable. The green residue on the skull is concentrated on the frontal bone (forehead) with a concentration of iron residue between the orbits. There is also some green residue on both the left and right side of the face. As for the green residue on the postcranial bones, it is mostly concentrated on the right hand. In fact most of the green residue appears on the right side of the individual, with some exceptions (1st rib left). The green residue on the tibia is on the posterior side, proximal and distal.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1627	1694	clavicle R	green residue	40	30	1,98	0,421	5,80	0,041	0,105	2,47	19	50	0,365
1628	1694	clavicle R	achtergrond meting	43	32	1,71	0,691	6,60	0,025	0,106	1,88	14	49	0,347
1629	1694	1st rib L	green residue	37	28	1,69	0,026	2,30	0,006	0,029	0,972	31	55	0,381
1630	1694	1st rib L	achtergrond meting	45	27	2,57	0,253	20	0,179	0,392	6,23	-2,115	40	0,360
1631	1694	scapula R	green residue	35	22	1,55	0,028	3,95	0,015	0,053	0,663	37	60	0,331
1632	1694	scapula R	achtergrond meting	36	25	1,91	0,259	11	0,099	0,204	3,08	22	54	0,360
1633	1694	RMC2	green residue (proximal)	38	28	3,18	0,128	15	0,115	0,268	4,49	11	46	0,592
1634	1694	RMC2	achtergrond meting	39	30	2,50	0,135	21	0,155	0,354	3,20	4,42	45	0,329
1635	1694	RMC4	green residue	31	27	2,71	0,023	4,26	0,013	0,104	1,31	33	57	0,364
1636	1694	RMC4	achtergrond meting	33	24	2,67	0,290	26	0,218	0,533	5,05	8,87	48	0,394
1637	1694	RMC5	green residue	25	19	2,42	0,021	3,47	0,007	0,046	0,454	50	67	0,318
1638	1694	RMC5	achtergrond meting	28	17	3,37	0,194	29	0,231	0,674	5,02	17	52	0,453
1639	1694	scaphoid R	green residue	40	28	2,69	0,114	14	0,113	0,266	3,97	12	46	0,485
1640	1694	scaphoid R	achtergrond meting	35	26	1,68	0,307	15	0,081	0,266	4,32	18	52	0,439
1641	1694	LMC1	green residue / geen achtergrond meting mogelijk	36	31	2,34	0,036	1,97	0,008	0,063	0,887	29	54	0,237
5515	1694	mandible M2 L	green residue	24	16	4,17	0,089	13	0,062	0,244	1,44	40	62	0,385
5516	1694	mandible left	achtergrond meting	40	30	1,9	0,299	4,58	0,028	0,092	1,79	22	52	0,215
5517	1694	parietal R ant	green residue	39	29	1,96	0,146	6,11	0,038	0,09	2,68	21	50	0,327
5518	1694	occipital	achtergrond meting voor geheel	36	25	2,57	0,366	17	0,2	0,403	3,5	15	50	0,2
5519	1694	frontal inf 1	green residue	22	15	2,59	0,068	10	0,126	0,221	1,26	48	68	0,305
5520	1694	frontal inf 2	green residue	35	21	2,4	0,08	4,07	0,023	0,068	1,16	37	60	0,361
5521	1694	frontal-orbits	iron residue	15	14	19	0,243	2,07	0,009	0,177	0,473	50	67	0,09
5525	1694	pelvis/acet R inf	green residue	33	24	2,16	0,149	6,17	0,061	0,129	1,48	33	59	0,214
5526	1694	ilium R ant	achtergrond meting	44	29	1,72	0,281	5,76	0,064	0,142	2,54	17	50	0,279
5527	1694	fem head R post	green residue	29	21	1,91	0,021	8,49	0,062	0,155	2,2	37	54	0,894
5528	1694	fem R shaft ant	achtergrond meting	53	40	1,62	0,292	4,66	0,036	0,097	2,77	-2,924	39	0,376
5529	1694	tibia post prox	green residue	32	20	2,17	0,027	4,08	0,044	0,07	1,21	40	62	0,33
5530	1694	tibia post dist	green residue	38	33	2,65	0,036	2,16	0,014	0,037	1,43	22	52	0,302
5531	1694	tibia post shaft	achtergrond meting	40	33	2,32	0,038	2,82	0,023	0,049	1,6	20	52	0,301
5543	1694	frontal central 1	green residue	36	29	1,21	0,056	2,23	0,011	0,054	1,04	30	55	0,387
5544	1694	frontal central 2	green residue	38	28	3,13	0,093	4,32	0,028	0,071	1,21	25	54	0,542
5545	1694	front-par R	green residue	41	30	1,93	0,074	6,85	0,053	0,123	2,36	17	50	0,317
5546	1694	sphenoid L	green residue	41	26	3,86	0,167	4,8	0,021	0,123	1,4	22	50	0,229
5547	1694	orbit L inf	green residue	27	14	2,42	0,089	4,44	0,04	0,088	0,782	51	68	0,108
5548	1694	orbit R sup	green residue	33	23	2,9	0,133	2,15	0,01	0,04	1,24	37	60	0,811
5549	1694	orbit L sup	green residue	17	22	16	0,291	2,45	0,033	0,215	0,507	41	62	0,161

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1627	148	26007	20584	4770	199	463	115	1,84	23	2,07	69	36	93	36	49	43
1628	275	27892	152	787	154	413	109	1,84	23	2,03	65	38	100	38	59	38
1629	170	26796	29679	10632	85	402	114	1,84	36	2,55	24	37	88	37	47	28
1630	127	24004	164	728	257	437	125	5,90	39	5,08	70	27	121	27	58	32
1631	90	17579	8066	4933	81	386	110	1,84	23	2,91	32	32	100	32	62	62
1632	87	25926	75	1494	222	397	157	2,03	23	1,85	82	29	106	29	58	37
1633	288	32729	14508	1298	360	431	121	6,81	31	3,12	81	32	116	32	49	29
1634	98	20348	261	1294	348	326	88	15	69	4,67	63	30	121	30	59	32
1635	254	23126	37999	472	110	304	91	1,84	23	1,68	57	26	108	26	51	32
1636	137	23992	272	1194	416	317	149	7,37	39	1,69	104	26	113	26	55	32
1637	138	19326	36206	541	139	204	106	1,84	23	1,98	46	34	110	34	57	38
1638	94	14012	970	1853	520	258	104	11	56	2,80	115	30	136	30	62	37
1639	269	21289	21329	2395	276	400	78	2,88	25	3,14	89	30	104	30	47	28
1640	116	17728	207	586	198	347	99	3,53	25	1,76	53	28	97	28	61	35
1641	279	23877	49735	1614	67	309	125	1,84	22	1,59	23	33	97	33	48	29
5515	71	12445	24142	3466	308	60	273	2,42	26	341	109	2,43	8,6	39	72	128
5516	147	16694	202	1143	102	31	87	1,84	22	304	34	1,5	5,8	31	50	31
5517	191	16964	17392	2286	144	43	89	1,84	22	309	45	2,72	4,8	32	51	31
5518	127	13949	113	1039	262	31	84	1,84	26	336	72	2,4	5,63	25	52	30
5519	87	14364	22535	1090	142	49	133	1,84	26	249	43	2,56	7,2	38	75	94
5520	93	14266	18216	1533	156	47	155	1,84	23	307	54	1,92	6,13	41	61	63
5521	112	12230	5245	317	16	38	107	1,84	23	318	20	1,71	4,65	30	61	52
5525	80	17342	17500	1692	164	34	127	1,98	29	260	58	1,51	5,28	25	52	36
5526	109	17414	66	779	221	52	88	2,27	24	353	84	2,62	6,04	42	56	37
5527	183	15072	99365	1448	126	57	133	4,98	34	255	93	3,67	6,09	28	53	45
5528	217	36109	47	1235	145	45	199	1,84	23	319	54	1,79	5,71	36	59	91
5529	69	12985	17845	1000	123	35	130	1,84	22	268	53	3,02	5,3	36	55	33
5530	133	17223	14618	1481	149	61	176	1,84	22	279	42	1,55	5,01	29	55	80
5531	165	29213	1149	3568	132	38	95	1,84	22	295	58	1,5	4,94	27	53	36
5543	238	18083	36260	3225	113	46	86	1,84	22	302	45	1,93	4,73	33	47	30
5544	201	22714	13529	2620	188	50	120	1,84	22	366	59	1,84	5,18	26	49	48
5545	180	16827	14178	1259	108	50	87	1,84	24	361	48	2,46	4,7	33	51	50
5546	75	29332	26003	1143	90	34	97	1,84	27	366	38	2,94	5,64	40	57	34
5547	101	15492	6084	3771	41	62	166	1,86	25	260	16	4,47	8,48	47	103	116
5548	184	21271	20128	1793	117	47	208	1,84	22	308	44	1,5	4,86	26	50	46
5549	52	12126	16303	3853	9,91	43	251	1,84	24	453	42	1,76	8,86	30	61	60

1695

OVERVIEW

Number:	1695	/ Crown number:	none
Reference number:	1695-V-VR		
Photo ID:	1900-1919		
Level (put/vlak/spoor):	5/1/5		

SUMMARY

Sex development:	FEMALE
Age-at-death:	23 years ± 3 years / used method: COMPLEX
Calculated stature:	151,17cm ± 3,72cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue present above and in the left orbit, on the sagittal suture, left parietal and on the coronal suture, proximal end ulna, both 1st ribs, fragment of glass
Pathological & remarks:	misaligned upper left canine, shovel-shaped incisor, enamel hypoplasia, caries, abscess in maxilla, periostitis on femora, cribra femoralis (right), slight lumbarisation/cranial shift

SKELETON STATUS

Presence:

Right	**General/Skull**	**Left**
General: humerus (no proximal or distal end), radius, ulna (no proximal or distal end), proximal femoral shaft and head, fragment of distal femoral end, proximal end tibia, fragments of tibia, 1st and 2nd rib, 5 rib heads, 1 rib shaft fragment; *Hand:* none; *Foot:* none.	Frontal, right zygomatic, anterior-medial side of both maxillae, left (fragmentary) and right parietal, fragment occipital, fragment left temporal, both clavicles (left no lateral end), both lateral sides of scapulae, superior part manubrium, sternum body, C2 (dens), T2-L5, S1-S3 (no left side), right ilium and ischium, left fragment of ilium and ischium.	*General:* humerus (no proximal or distal end), proximal ulnar shaft, proximal femoral shaft and head, fragment of distal femoral end, fragment of proximal end tibia and shaft, fibular shaft, 1st rib, 9 rib heads, 1 rib shaft fragment; *Hand:* trapezium, 1st - 4th metacarpals; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	M	M	M	A	P	A	P		P	I	I	P	P	M	M	I
										h	h					h
												h	h			
M	M	M	M	M	M	M	M		M	M	P	I	I	A	A	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- The upper left canine (23) is misaligned due to crowding in the maxilla. It overlaps with the 22, where the 23 is posterior to the 22 and points with its labial side towards the lingual side of 22.
- An abscess is present at the location of 21.
- The incisor that could be observed is shovel-shaped.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on all teeth inspected. The location of the hypoplasia suggests there was a metabolic upset around the age of 3 years, and again around the age of 4 years. Hypoplasia on the M3 suggest another metabolic upset around the age of 11 years.
- On both femora periostitis is present. This is located on the shaft, is diffuse, and sclerotic. Also, cribra femoralis is present on the right femur.
- Marginal osteophytes are present on the inferior surface of the T9 and superior surface of the T10, as well as on the inferior surface of the T11. Schmorl's nodes are present on the inferior surface of the T11, and on both surfaces of the T12.
- The first sacral vertebral body is morphologically similar to the L5. Though this is not very prominent, it does indicate a slight lumbarisation (or cranial shift).

SEX ASSESSMENT

- The sexualization degree of the pelvis is -1,3. In total 47,36% of the pelvis could be scored.
- The sexualization degree of the cranium is -1. In total 45,83% of the cranium could be scored. The sexualization degree of the mandible is -0,16, and in total 75% could be scored. In total the skull has a sexualization degree of -0,7 and could be scored for 53,12%.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the spongiosa in the proximal end of the femur and the humerus, as well as the endocranial suture obliteration. Both the spongiosa of the femur and the humerus were observed without sawing the bones; due to fragmentation the phases could be assessed. Both were in phase I. The endocranial suture obliteration was also in phase I, which gives an age-at-death at 23 years with an age range of 3 years.
- The auricular surface could also be used for an age-at-death assessment. The age range was 25-29 years (phase II).
- The epiphyseal fusions that could be observed correlate with the above mentioned age ranges. The epiphysis of the medial clavicle was fused (age older than 20 years), and both the iliac crest as well as the sacral vertebral bodies were fused, though the epiphyseal line is still slightly visible.

ESTIMATION OF ANTE MORTEM STATURE

- Only the method of Trotter and Gleser could be used. The length of the femur was he only measurement available; this resulted in a stature of 151,17cm with a standard deviation of 3,72cm.

DESCRIPTION ARTEFACTS

- Apart from the green residue, a fragment of glass was found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1681	1695	1st rib R	green residue	28	20	3,08	0,116	15	0,085	0,322	3,31	30	57	0,620
1682	1695	1st rib R	achtergrond meting	36	24	3,06	0,326	29	0,225	0,613	6,54	0,224	43	0,387
1683	1695	2nd rib R	green residue	23	16	2,13	0,023	32	0,192	0,552	5,30	21	53	0,640
1684	1695	2nd rib R	achtergrond meting	31	24	3,02	0,226	27	0,213	0,523	4,86	9,33	49	0,295
2470	1695	parietal L	green residue	32	30	2,25	0,211	3,84	0,030	0,068	0,894	31	56	0,208
2471	1695	parietal L	green residue sagittal suture	30	26	2,88	0,334	9,35	0,042	0,157	2,36	29	56	0,264
2472	1695	parietal L	achtergrond meting	39	35	4,56	0,249	10	0,061	0,199	2,19	8,37	46	0,157
2473	1695	parietal R	green residue sagittal suture	26	21	2,69	0,073	12	0,059	0,182	1,87	37	60	0,426
2474	1695	parietal R	achtergrond meting	15	15	3,11	0,232	54	0,293	0,944	4,90	7,80	52	0,228
2475	1695	temporal L	green residue	27	20	2,04	0,080	24	0,126	0,433	5,03	22	54	0,449
2476	1695	temporal L	achtergrond meting	29	18	2,38	0,256	15	0,093	0,306	1,51	34	61	0,160
2477	1695	temporal L	(past niet op ander fragment) green residue	30	22	1,72	0,186	18	0,071	0,286	3,84	24	53	0,358
2478	1695	temporal L	(past niet op ander fragment) achtergrond meting	31	23	4,23	0,535	20	0,152	0,375	3,19	17	52	0,262
3480	1695	frontal-orbit L	green residue	25	17	1,61	0,022	8,45	0,04	0,161	1,45	46	63	0,507
3481	1695	frontal-coronal suture	green residue	29	25	2,78	0,038	4,31	0,02	0,049	1,42	37	58	0,677
3482	1695	frontal	achtergrond meting	32	26	3,59	0,117	6,27	0,046	0,121	1,9	29	57	0,28
3483	1695	ulna R	green residue	29	20	1,77	0,135	15	0,077	0,29	1,64	33	59	0,15
3484	1695	ulna R	achtergrond meting	37	29	2,58	0,271	7,18	0,049	0,163	1,55	21	53	0,14

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1681	191	21461	17961	5251	626	381	94	1,84	23	1,83	173	27	122	27	56	34
1682	314	23238	454	1292	574	360	94	9,15	27	4,63	123	28	118	28	52	28
1683	154	13235	17466	2516	670	231	108	1,84	40	1,50	188	24	93	24	50	31
1684	321	18811	307	1086	523	332	106	7,61	25	3,22	88	41	124	41	55	37
2470	412	22950	41830	5761	97	370	196	1,84	21	1,50	39	35	62	35	31	45
2471	651	22054	30743	5208	248	367	182	1,84	21	1,50	62	38	68	38	32	50
2472	619	34853	252	999	227	398	165	2,20	21	1,50	45	56	87	56	34	48
2473	318	26789	35853	4004	330	296	213	1,84	21	1,50	105	44	74	44	36	76
2474	87	12692	174	483	379	248	186	16	85	1,50	76	47	74	47	34	45
2475	207	15765	16233	5069	355	277	166	1,84	21	1,50	92	35	54	35	30	52
2476	122	23655	104	838	262	240	230	4,08	34	1,50	36	56	85	56	47	92
2477	265	27134	32024	3897	294	323	166	1,84	21	1,50	90	55	54	55	30	50
2478	340	19970	1175	3882	235	358	134	2,44	23	1,50	59	55	84	55	33	47
3480	161	11624	45660	6910	450	59	242	1,84	22	283	150	1,5	5,93	47	43	92
3481	202	14410	29848	5882	429	72	227	1,84	21	327	141	1,5	5,02	50	40	53
3482	927	22474	3821	4145	206	50	179	1,84	21	310	63	1,5	3,94	38	40	61
3483	378	19242	21708	4514	136	54	213	2,35	23	316	27	1,5	4,15	42	42	55
3484	501	15816	690	3298	135	48	163	3,14	21	307	27	1,5	3,62	38	41	76

1707

OVERVIEW

Number:	1707	/ Crown number: 1707
Reference number:	1707-K-O	
Photo ID:	1365-1381	
Level (put/vlak/spoor):	5/1/9	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	2 years ± 8m	/ used method: dental
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue is present on skull fragments and on neural arches. One fragment of glass present.	
Pathological & remarks:	very fragmented	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: - *Hand:* - *Foot:* -	Left petrous pyramid, 7 rib fragments, 10 neural arches (unfused), 6 fragments of neural arches, 1 fragment of the right scapula (lateral)	*General:* - *Hand:* - *Foot:* -

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			M	M	I	I	I		I	I	I	I	M			

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
							U		U							
		U				U	U							U		
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

			M	I	I	I	I		M	I	I	I	M			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

– All teeth not present in mandible or maxilla fragments. All unerupted permanent incisors have fully developed crowns, whereas all unerupted permanent molars have almost fully developed crowns.

PATHOLOGICAL/REMARKS

- No pathological remarks visible.

SEX ASSESSMENT

- Not possible due to age.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed at 2 years with an age interval of 8 months.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1571	1707	skull frag	green residue geen achtergrond meting mogelijk	35	34	5,05	0,042	2,72	0,019	0,082	2,60	20	48	0,464
1572	1707	skull frag	green residue geen achtergrond meting mogelijk	32	31	5,06	0,076	6,62	0,027	0,141	2,40	23	49	0,382
1573	1707	neural arch	green residue geen achtergrond meting mogelijk	22	18	6,86	0,166	11	0,059	0,320	2,67	39	56	0,505
1574	1707	neural arch	green residue geen achtergrond meting mogelijk	20	19	4,35	0,056	20	0,081	0,392	3,74	34	59	0,435

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1571	610	23065	57155	5934	410	550	117	1,84	24	2,96	148	26	142	26	50	29
1572	345	21238	60585	4013	356	478	86	1,84	23	2,53	98	25	139	25	50	30
1573	946	16516	85734	4123	618	459	111	2,13	25	2,24	173	32	172	32	61	39
1574	230	14485	48077	1924	470	332	163	1,84	25	2,15	115	32	144	32	64	42

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	1.707.007	MXX	koperdraad	76,18	<0,0	0,13	4,75	0,33	<0,0	<0,0	<0,0	0,20	18,08	zilver: ja	goud: ja

1773

OVERVIEW

Number:	1773	/ Crown number: none
Reference number:	1773-J-O	
Photo ID:	2014-2028	
Level (put/vlak/spoor):	2/11/153	

SUMMARY

Sex development:	INDETERMINABLE / probably female	
Age-at-death:	14 – 16 years	/ used method: dental/fusions
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue is present on the right zygomatic	
Pathological & remarks:	juvenile thoracic vertebrae, shovel-shaped incisor, cortical defect	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus (no proximal shaft) and proximal epiphysis, femur with distal epiphysis, tibia with proximal epiphysis, fibula with no epiphyses, 1st rib (fragmentary), 3 rib heads high, 3 rib heads low; *Hand:* 2nd - 5th metacarpal, 3 proximal, 3 intermediate and 2 distal phalanges; *Foot:* talus, calcaneus, navicular, cuboid, lateral cuneiform, all metatarsals, 1 proximal phalange;	Frontal, both zygomatics, fragments of maxilla, fragments of superior parietals, fragments of occipital, mandible, both clavicles, both lateral sides scapulae, fragment of sternum body, all vertebrae, sacrum, pelvis.	*General:* humerus (no proximal shaft) and proximal epiphysis, radius with distal epiphysis, ulna with distal epiphysis, femur with distal epiphysis, tibia with proximal epiphysis, fibula with no epiphyses, all ribs except 12; *Hand:* hamate, lunate, triquetral, 2nd, 4th and 5th metacarpal, 4 proximal phalanges; *Foot:* talus, calcaneus, navicular, cuboid, lateral and medial cuneiform, all metatarsals, 1st proximal phalage.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
U	I	I	I	P	P	I	M		P	I	P	I	I	I	I	U
R1/4	A1 / 1+	3-								h				h / 3-	h / A1 / 1+	R1/4
						h	h		h	h				3-	1+	
U	P	P	P	I	P	I	I		I	I	I	I	I	I	I	U
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- All teeth show almost no dental wear, caries or calculus.
- In the lower jaw, the unerupted M3's could not be inspected as they were unerupted.
- The right upper lateral incisor is shovel-shaped, the left upper lateral incisor is not.

PATHOLOGICAL/REMARKS

- The neuro-central junction has not completely fused yet in the T vertebrae, which does not correspond with all the other age indicators of this individual.
- A cortical defect is present on the right clavicle.

SEX ASSESSMENT

- Not possible due to age, though the traits of the pelvis score female. The long bones are quite gracile, as is the skull.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed in the phase of 15 years (with an age range of 36 months).
- For the general part, the fusions of the axial skeleton and the long bones correspond with this. The female age range has been taken into account when estimating the skeletal age. As with the unfused proximal tibia, the age range would be 14-18 years. However, both proximal and distal epiphyses of the fibulae have not yet fused. This would mean the individual is younger than 15. The lesser trochanter of the femur is fused, which would indicate an age older than 16. Also, the acetabulum has already fused, which would set the age to older than 15 years. With all fusions and their age ranges taken into account, the age range of 14-16 years was taken. The neuro-central junction has, however, not yet completely fused in the T vertebrae.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1687	1773	zygomatic R	green residue	36	34	1,93	0,211	5,63	0,013	0,100	2,50	20	51	0,595
1688	1773	zygomatic R	extra meting green residue	35	33	2,11	0,158	5,98	0,031	0,117	2,34	21	53	0,636
1689	1773	zygomatic R	achtergrond meting	42	34	3,46	1,12	9,92	0,099	0,223	3,20	5,92	45	0,257

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1687	333	19013	3639	589	561	311	145	1,84	22	1,50	162	24	91	24	50	472
1688	318	31593	3847	598	544	316	115	1,84	22	1,50	154	24	95	24	49	495
1689	321	21397	98	745	472	477	101	4,74	26	2,48	106	29	128	29	52	32

1796

OVERVIEW

Number:	1796	/ Crown number:	none
Reference number:	1796-V-VR		
Photo ID:	1774-1784		
Level (put/vlak/spoor):	2/12/159		

SUMMARY

Sex development:	FEMALE
Age-at-death:	52 – 61 years / used method: COMPLEX
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue above the right orbit
Pathological & remarks:	DDD in C3-C6, left radius fracture distal, persisted foramen of Huschke, some marginal osteophytes in right shoulder joint, hyperostosis frontalis interna

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus (no proximal end), radius (no distal end), ulna (only proximal end), femur (no distal end), part of proximal tibial shaft; *Hand:* 1st metacarpal, proximal end 3rd metacarpal, fragments of a metacarpal, proximal and distal phalange; *Foot:* proximal end of 3rd metatarsal.	Most of the superior part of the cranium, mandible, left maxilla (fragmentary), fragments of both temporals, both clavicles (no lateral ends), fragments of scapulae, 10 rib fragments, C1-C6, fragment left ilium (greater sciatic notch), 3 fragments acetabulum.	*General:* distal end humerus, radius (fragmentary, no proximal end), ulna (only proximal end), fragment of femoral head; *Hand:* 2 fragments of metacarpals, 3 proximal phalanges; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
I	M	M	M	M	I	I	I		M	P	P	P	A	P	A	M
A	A	A	I	P	P	P	P		P	P	P	P	P	A	A	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Reconstructing dental data was difficult, the element placed for 45 is a possibility.
- An abscess is present above the socket of 23.
- The lingual-occlusal surface of the 12 is completely gone.

PATHOLOGICAL/REMARKS

- Marginal osteophytes are present in the right shoulder joint.
- VOA is present in the cervical region. The inferior body of the C3, the complete body of the C4, C5 and C6 have marginal osteophytes.
- There is some slight depression on the distal anterior surface of the left radius. The left radius has also a fracture distally; this has some angulation frontal-dorsal.
- On both sides, there is a persisted foramen of Huschke.
- Hyporostosis frontalis interna is present.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -1. In total 42,1% of the pelvis could be scored.
- The sexualization degree of the cranium is -0,5 and could be scored on 66,6%. The mandible has a sexualization degree of -0,16 and could be scored on 75%. In total the skull has a sexualization degree of -0,45 and could be scored on 68,75%.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the femur. The endocranial suture obliteration was in phase IV. The spongiosa in the proximal end of the femur was in phase III. This gives an age-at-death between 52-61 years.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to the fact no complete long bones were present.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1520	1796	orbit R	green residue	26	19	2,44	0,028	13	0,068	0,270	2,82	37	60	0,950
1521	1796	parietal R	achtergrond meting	42	30	1,95	0,075	7,32	0,024	0,131	1,39	16	50	0,192

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1520	158	22582	21328	3043	1021	247	90	1,84	22	1,62	277	39	102	39	51	43
1521	155	19979	72	375	203	308	97	1,84	23	2,82	37	36	105	36	57	37

1831

OVERVIEW

Number:	1831	/ Crown number:	none
Reference number:	1831-V-M		
Photo ID:	1687-1707		
Level (put/vlak/spoor):	5/5/29		

SUMMARY

Sex development:	MALE
Age-at-death:	47 years ± 3 years / used method: COMPLEX
Calculated stature:	170cm ± 3,27cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue is present on the lamboid suture (right parietal-occipital), on the distal end of right radius and on the 4th right proximal hand phalange
Pathological & remarks:	Severe dental wear and caries, enamel hypoplasia, slight cranial shift, slightly bowed lower limbs (vitamin D deficiency), VOA, maxillary sinusitis, periostitis, cortical defects, possible spondylolisis, bathycrani, some torus maxillaris, hyperplasticity tibiae-radii-ulnae, subchrondal cysts acetabulum left and right, hyoid not ossified, possible ribfracture (sternal end 2nd left)

SKELETON STATUS

Absent:

Right	General/Skull (presence!)	Left
General: patella, sternal ends of all ribs; *Hand:* trapezoid, hamate, triqetral, pisiform, 2nd - 4th metacarpals, 1st and 5th proximal phalanges, 2nd, 3rd and 5th intermediate phalanges, all distal phalanges; *Foot:* navicular, cuboid, all cuneiform, 1-4th metatarsals and all phalanges.	Fragment of right frontal and zygomatic, mandible, fragment of right maxilla, complete left maxilla and zygomatic, fragments of both temporals, both parietals (no anterior aspect) and occipital, both clavicles, scapulae (no lateral border), all vertebrae, sacrum, complete pelvis except for left pubis and right pubic symphysis.	*General:* distal end ulna, sternal ends of ribs 1-5 and 10-12; *Hand:* scaphoid, trapezium, trapezoid, capitate, hamate, pisiform, all bones for the 5th finger, 2nd intermediate phalange, 1st - 5th distal phalange; *Foot:* talus, navicular, cuboid, lateral cuneiform, intermediate cuneiform, 1st and 2nd metatarsals, all proximal, intermediate and distal phalanges.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
A	P	P	A	P	I	I	I		I	I	I	I	P	P	P	P
											c	c				
c	2	3 / c / h	c										c			4+ / c
I	I	I	I	I	I	I	I		I	I	I	I	I	A	P	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Some slight torus maxillaris is present on the lingual side of 26-27.
- Because of caries only the root of 24 and 35 are present. On 48, 46 and 38 there is caries present (twice distal and buccal side respectively) and half of the crown is completely gone. On 47 there is also caries present (much smaller) on the mesial side. Interproximal caries are present between 46-45 and 24-25.
- All of the incisors and canines show a lot of dental wear. There are sharp edges on the enamel, indicating some force has been placed on the teeth.
- Calculus is present on the lower incisors and canines, on the labial side.
- The lateral upper incisors are shovel-shaped. The upper left canine is different in morphology.
- Abscesses are present above 17 (in maxillary sinus), 26 (towards the maxillary sinus) and below 46 (also with fistula).

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location (and multiple hypoplasia lines) suggests there was a metabolic upset around the ages of 2,5-4 years (right lower M1, right lower C). Another hypoplasia line on the left lower M3 was formed around the age of 11 years.
- There is some slight vitamin D deficiency visible. Both tibiae and fibulae are slightly bowed. This is only present in the proximal ends, and they are bent laterally. Both femora are also slightly bowed, but these are bent anteriorly. There is also some hyperplasticity visible in both tibiae, radii and ulnae.
- A slight cranial shift is present in the vertebrae. There is a lumbarization of the S1 and sacralisation of the Co1. The L1 shows no cranial shift. The T1 has some slight cervical elements. In the L5 there is possible spondylolisis present.
- VOA is present on the inferior facets of the T8 and on the superior facets of the T9. It is also present on the left inferior facet of the T9 and the left superior facet of the T10. Marginal osteophytes are present on the inferior facets of the L4 and the superior facets of the L5.
- Maxillary sinusitis is present on both sides, though right more prominent than left. The new bone formation is spicule, local and woven. An abscess is present in the right maxillary sinus (above 17) and in the left the abscess is towards the maxillary sinus (above 26). In the mandible, below 46, there are 2 fistulae and an abscess. Torus maxillaris is present on the lingual side of 26-27.
- The greater horn has not yet ossified with the body, a fusion that happens normally during

puberty.
- On both the clavicles a cortical defect is present.
- Bathycrani.
- Subchondral cysts are present on the right and left acetabulum.
- There is a possible fracture on the sternal end of the left 2nd rib.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +0,84. In total 89,5% of the pelvis could be scored. All traits could be scored except the pubic angle.
- The sexualization degree of the cranium is +1. The skull could not be scored on all traits, as 63,15% was scored. The sexualization degree of the mandible is +1,25 and could be scored on all traits. In total the skull has a sexualization degree of +1,1, with 68,75% scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase V. Both the spongiosa in the proximal end of the femur was in phase II, the humerus in phase III. This gives an age-at-death at 47 years with an age range of 3 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase IV/V (age-at-death: 35-44).

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. The length of the tibiae was used in the method of Breitinger (smaller standard deviation). With this method this resulted in a stature of 171,43cm with a standard deviation of 4,70cm. With the method from Trotter & Gleser, where the length of the femora was used, this was 170cm with a standard deviation of 3,27cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1522	1831	radius R	green residue	38	29	1,54	0,085	12	0,073	0,122	2,58	17	51	0,512
1523	1831	radius R	extra meting green residue (meer prox.)	36	26	1,83	0,047	6,89	0,070	0,104	1,65	28	56	0,591
1524	1831	occipital	green residue	31	27	2,47	0,029	0,863	0,003	0,028	0,998	37	59	0,817
1525	1831	parietal R	achtergrond meting	37	22	1,40	0,352	22	0,175	0,409	5,05	12	48	0,509
1526	1831	radius R	achtergrond meting	40	33	2,68	0,375	2,25	0,019	0,065	1,37	21	52	0,397
5553	1831	prox ph 4 R?	green residue	33	25	1,38	0,03	11	0,058	0,167	3,2	25	55	0,529
5554	1831	prox ph 4 R?	achtergrond meting	36	31	1,08	0,083	3,2	0,012	0,061	1,65	27	56	0,469

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1522	368	20572	6318	531	347	331	87	1,84	89	2,84	96	35	88	35	51	32
1523	302	17230	12558	462	573	305	87	1,84	80	2,81	165	28	94	28	50	40
1524	234	17820	17065	3398	871	273	136	1,84	22	1,50	252	34	103	34	51	32
1525	248	19104	42	474	499	323	98	2,97	25	2,16	154	29	94	29	60	36
1526	276	24559	59	960	228	382	216	1,84	23	3,03	60	29	116	29	61	69
5553	81	20248	10608	966	467	32	97	1,84	25	252	84	1,5	6,47	25	50	30
5554	322	14878	69	1172	287	49	156	1,84	22	223	100	1,5	5,21	31	49	51

1835

OVERVIEW

Number:	1835	/ Crown number:	none
Reference number:	1835-V-M		
Photo ID:	2029-2049		
Level (put/vlak/spoor):	5/5/30		

SUMMARY

Sex development:	MALE
Age-at-death:	36,33 years ± 3yrs / used method: COMPLEX
Calculated stature:	164,62cm ± 2,99cm /used method: Trotter & Gleser (fem+ti)
Artefacts/crown/ residue on bone:	green residue on sagittal suture and on foramen magnum
Pathological & remarks:	very fragmented, severe dental wear, enamel hypoplasia, crowding in maxilla, caries, abscess and fistula in maxilla, maxillary sinusitis, torus palatinus, cortical defect, muscle attachment right clavicle pronounced, sacralisation or lumbarisation; difficult to determine

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus, radius, ulna, femur (no distal-medial and distal-lateral sides), tibia (with eroded anterior-proximal side), 4 rib heads, 4 rib shaft fragments; *Hand:* hamate, 1st - 5th metacarpal, 3 proximal phalanges, 2 intermediate phalanges; *Foot:* talus, fragment of calcaneus, cuboid, 1st metatarsal.	Fragment right-lateral side of the frontal-orbit, right zygomatic, right maxilla, fragment of left maxilla, mandible, right temporal, fragment left temporal, fragments of the right and left parietal (posterior), fragments of occipital, both clavicles, both scapulae (right complete, left lateral side), C1-C2, 7 T fragments, 3 L fragments, right and left ilium with acetabulum and partial ischium, Indeterminable: 1 proximal hand phalange, fragments of fibula.	*General:* humerus (no distal-medial side), radius (no proximal end and eroded distal end), ulna (no proximal end), femur, tibia, 1 rib shaft fragment; *Hand:* 2nd - 5th metacarpal (with no proximal ends); *Foot:* talus, fragment of calcaneus, navicular, cuboid, all metatarsals (2nd - 4th with no distal end), 2 proximal phalanges.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
A	P	I	I	I	I	I	I		I	I	I	I	P	I	P	P
		5-												c		
	4	5	h		h								c	5+		
A/U	I	I	I	I	I	I	I		I	I	I	I	I	I	A	P
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Dental wear is severe; mostly on the molars, premolars and canines.
- Caries is present on the distal surface of 35. It is also present at 26; because of caries only the root is still present.
- Calculus is present between most of the teeth (interproximal).
- 22 is slightly misaligned, it is aligned more distally. This is because of crowding in all of the upper incisors.
- An abscess and fistula are present at the location of 27, of which the fistula reaches the maxillary sinus.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggest there was a metabolic upset around the age of 2.7 years and again around the age of 3.6 years.
- Maxillary sinusitis is present both left and right. The new bone formation is lamellae and sclerotic, and is local.
- A cortical defect is present on the right humerus. Also, the muscle attachments on the right clavicle are more pronounced.
- Due to fragmentation, the spine could not be inspected. From what is observable, there are indications for either a lumbarisation or sacralisation.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +0,1. In total 47,31% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,2 and in total 41,66% could be scored. The sexualisation degree of the mandible is +0,5 and could be scored on all traits. In total the skull has a sexualization degree of +0,33 and 56,25% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase I. The spongiosa in the proximal end of the femur was in phase I and the spongiosa in the proximal end of the humerus was in phase II. This gives an age-at-death at 33 years with an age range of 3 years.

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. The length of the humerus was used in the method of Breitinger (smaller standard deviation). With this method this resulted in a stature of 165,7cm with a standard deviation of 4,9cm. With the method from Trotter & Gleser, where the length of the femur and tibia was used, this was 164,62cm with a standard deviation of 2,99cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1651	1835	parietal R	green residue	34	27	2,08	0,114	9,17	0,060	0,151	2,37	25	54	0,478
1652	1835	parietal R	achtergrond meting	31	21	2,09	0,395	13	0,107	0,297	2,18	30	59	0,293
1653	1835	occipital	green residue	19	11	0,884	0,068	9,31	0,051	0,104	0,657	59	75	0,358
1654	1835	occipital	extra meting green residue	32	24	1,05	0,296	3,43	0,012	0,049	0,549	39	63	0,302
1655	1835	occipital	achtergrond meting	34	25	2,87	0,601	17	0,130	0,363	2,94	16	51	0,234
1656	1835	parietal R-L	green residue geen achtergrond meting mogelijk	35	30	2,47	0,061	2,26	0,006	0,053	0,792	29	56	0,538

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1651	430	24703	22620	3557	761	269	88	1,84	22	1,50	184	25	94	25	51	40
1652	481	14781	234	579	567	244	94	1,84	23	1,64	136	27	101	27	53	34
1653	189	22622	4313	2445	102	214	251	2,47	26	4,34	23	54	139	54	129	89
1654	204	29007	5070	3655	28	272	160	1,84	23	2,03	11	34	89	34	65	67
1655	316	16635	239	596	454	245	102	3,00	22	1,83	86	25	111	25	52	47
1656	417	22518	14373	6302	424	276	88	1,84	22	1,53	119	27	103	27	50	44

1875

OVERVIEW

Number:	1875	/ Crown number:	none
Reference number:	1875-V-M		
Photo ID:	1969-1988		
Level (put/vlak/spoor):	6/3/9		

SUMMARY

Sex development:	MALE
Age-at-death:	48 - 57 years / used method: COMPLEX
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue on both the bone and sutures of parietal temporal, on sagittal suture (on top of head), manubrium, on two rib shafts, iron residue on left parietal (close to lamboid suture)
Pathological & remarks:	DDD in cervical vertebrae, bowed lower limbs (vitamin D deficiency), general hyperplasticity in lower arms and legs, endocranial new bone formation, cribra orbitalia, caries, crowding in mandible, abscess and fistula in maxilla, calculus, maxillary sinusitis

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: fragments of distal humerus and humeral head, proximal end ulna, radial shaft and distal end, proximal end and shaft femur, patella, tibial shaft, fibular shaft, 2nd rib shaft, 7 rib heads, 2 sternal rib ends; *Hand:* hamate, 1st - 3rd metacarpal, 2nd and 5th proximal phalange; *Foot:* fragments of talus and calcaneus.	Large fragments of frontal, most of superior cranium present (right parietal-occipital), fragments of left and right parietal, both temporals, mandible, right zygomatic with maxilla, both clavicles (no lateral end), lateral sides scapulae, manubrium and fragment body, C1, C2 (dens), 4 C and 10 T vertebral bodies, L1-L5, S1 (and other S vertebrae (fragmentary), right and left ilium, fragments of right iliac crest.	*General:* humerus (no humeral head), distal end ulna, proximal end radius and shaft, proximal end femur and shaft, patella, fibula (no proximal end, 1st rib head and shaft, 6 rib heads, 8 rib shaft fragments; *Hand:* hamate, capitate, 2nd, 4th and 5th metacarpal, 2nd and 5th proximal phalange; *Foot:* fragments of talus and calcaneus.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
A	I	P	P	P	I	I	I		I	I	I	A	I	I	I	P
	2 / c				h	h	h		h		h / c			2+	2+ / c	
3+			c			h	h				h					
I	A	A	I	I	I	I	I		I	I	I	I	I	A	A	P
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Dental wear is severe, especially on the canines.
- Caries is present on the mesial surface of 17 and 27. Caries is also present on the occlusal surface of 23 and 45.
- Calculus is present on the CEJ of 23, 25 and 27 and between the 32 and 33.
- 42 is slightly misaligned, it is orientated towards the 43, which is the result of crowding in the mandible.
- There is a small black line on the enamel, just above the CEJ of 48.
- Hypoplasia is present, but is only slightly visible and therefore not taken into the pathological remarks.

PATHOLOGICAL/REMARKS

- In the lower limbs there are symptoms of rickets visible. Both femora are bowed anterior-posterior, but this is more prominent in the right femur. The right tibia is bowed medio-lateral in its proximal end. The left fibula is also bowed medio-lateral. The muscle attachments in the tibia as well as in the fibula are very prominent. The right patella is also relatively enlarged, and there are indications for hyperplasticity in the lower arms. All of this indicates a vitamin D deficiency, but another factor (fracture?) might also have influenced the bowing of the limbs.
- The C vertebrae and T vertebrae have marginal osteophytes, which is in one C vertebra (indeterminable) severe. Due to fragmentation, the these vertebrae could not be fully analysed, but DDD is present in the cervical and thoracic regions. Schmorl's nodes are present on the inferior surface of the T8, on both surfaces of the T12, only observerable on the inferior surface of the L1, and on the inferior surface of the L3. Marginal osteophytes are present on the L2 (inferior and superior), the L4 (inferior) and L5 (inferior and superior). The L5 has on the right side an extra facet with the sacrum.
- Endocranial new bone formation is present, this is located along the sagittal suture. This is also present along the left and right temporal; this is sclerotic new bone formation. On the area posterior of to the sella turcica there is mixed new bone formation present.
- Cribra orbitalia is present in the left orbit.
- Maxillary sinusitis is present on both sides; the new bone formation is lamellae and mixed, and this is diffuse.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +0,5. In total 31,57% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,8, and in total 41,66% could be scored. The sexualization degree of the mandible is +1 and could be scored on all traits. In total the skull has a sexualization degree of +0,88 and could be scored for 56,25%.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the femur. The endocranial suture obliteration was in phase III and the spongiosa in the proximal end of the femur was in phase III. This gives an age-at-death between 48 – 57 years.

ESTIMATION OF ANTE MORTEM STATURE

- This could not be done due to fragmentation of the long bones.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1657	1875	parietal L	green residue	39	30	0,860	0,034	3,28	0,018	0,042	1,21	25	52	0,590
1658	1875	parietal L	achtergrond meting	41	29	1,92	0,031	2,47	0,068	0,045	0,685	25	54	0,295
1659	1875	manubrium	green residue	30	23	2,83	0,054	7,59	0,046	0,158	1,20	36	59	1,12
1660	1875	manubrium	achtergrond meting	28	23	2,51	0,076	17	0,163	0,408	3,50	25	57	0,310
1661	1875	parietal R	green residue	34	27	1,45	0,064	4,81	0,005	0,049	1,72	31	57	1,03
1662	1875	parietal R	achtergrond meting	40	31	3,20	0,159	7,38	0,070	0,158	2,54	16	48	0,295
1663	1875	temporal R	green residue	46	36	2,05	0,045	3,59	0,029	0,068	2,33	10	41	2,93
1664	1875	temporal R	achtergrond meting	37	30	1,90	0,173	7,78	0,065	0,176	2,58	20	53	0,253
1665	1875	temporal L	green residue	38	31	1,31	0,067	2,70	0,014	0,043	1,21	26	51	1,21
1666	1875	temporal L	achtergrond meting	40	28	1,33	0,061	13	0,075	0,221	4,01	13	47	0,393
1667	1875	parietal L	iron residue achtergrond meting 1658	11	12	17	0,068	38	0,274	0,767	4,23	17	53	0,375
1668	1875	rib	green residue	33	22	1,70	0,050	5,90	0,030	0,106	1,36	36	61	0,316
1669	1875	rib	achtergrond meting	34	22	2,42	0,150	23	0,197	0,488	5,59	11	49	0,403
1670	1875	rib	green residue	36	25	4,12	0,129	11	0,091	0,257	2,43	21	51	0,429
1671	1875	rib	achtergrond meting	27	22	2,51	0,258	16	0,087	0,307	3,23	28	59	0,303
1695	1875	parietal L-R	green residue	31	25	1,58	0,049	3,98	0,015	0,075	1,36	37	59	0,744
1696	1875	parietal L-R	achtergrond meting	41	32	1,49	0,026	4,20	0,030	0,078	1,23	20	53	0,364

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1657	435	20260	14757	3060	295	246	79	1,84	22	2,53	95	24	63	24	47	29
1658	804	26442	99	455	141	304	88	1,84	24	2,13	43	26	104	26	54	32
1659	394	21136	15613	4659	1698	275	165	16	37	1,72	370	28	114	28	51	40
1660	741	14262	340	382	554	214	142	35	117	4,19	26	22	97	22	45	27
1661	933	18510	12559	3619	531	236	135	1,84	23	2,57	164	25	81	25	50	31
1662	586	21643	222	992	494	346	89	2,44	24	3,02	131	36	124	36	53	32
1663	1878	26618	7081	4520	3378	326	80	2,93	23	4,74	987	31	103	31	51	29
1664	580	29786	207	1337	283	266	221	2,68	29	1,69	89	33	101	33	58	48
1665	577	20687	37250	8414	1409	275	80	1,84	23	2,59	425	24	78	24	50	29
1666	604	23116	158	767	212	272	92	1,84	23	2,06	62	25	82	25	50	31
1667	183	10814	163	209	1151	260	99	7,54	82	1,87	186	26	234	26	58	50
1668	223	20838	2419	1702	197	210	98	1,84	32	2,53	36	41	104	41	58	35
1669	626	21931	144	558	390	246	87	14	62	2,05	61	32	106	32	50	30
1670	333	26186	13463	4549	450	324	93	11	47	5,48	81	28	150	28	59	32
1671	232	25698	215	544	323	194	94	8,57	47	2,62	33	40	115	40	57	34
1695	431	27998	27410	6217	627	250	107	1,84	22	1,52	189	31	81	31	47	46
1696	879	30835	72	482	196	282	132	1,84	23	2,87	48	25	87	25	52	32

1887

OVERVIEW

Number:	1887	/ Crown number:	none
Reference number:	1887-V-VR		
Photo ID:	2071-2092		
Level (put/vlak/spoor):	5/7/51		

SUMMARY

Sex development:	FEMALE
Age-at-death:	63,5 years ± 2,5yrs / used method: COMPLEX
Calculated stature:	159,7cm ± 3,55cm / used method: Trotter & Gleser (fem+ti)
Artefacts/crown/ residue on bone:	green residue on both temporals and on top of head (sagittal suture), manubrium
Pathological & remarks:	ossification tendons manubrium, abscesses and fistulae in maxilla, ossified xyphoid, indications for possible DISH, surface porosity of vertebrae and sternum, not completely fused basilar-occipital, cleft arch S1

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: all long bones, 1st, 2nd - 11th rib (no sternal ends), 2 rib shaft fragments; *Hand:* lunate, triquetral, hamate, capitate, trapezoid, trapezium, all metacarpals, 1st, 2nd and 3rd proximal phalange, 3rd and 4th intermediate phalange; *Foot:* talus, calcaneus, navicular, cuboid, all metatarsals, 1st proximal phalange, 1 proximal phalange.	Complete skull present, though the tooth sockets in the maxilla are missing, both clavicles, lateral side left scapula, manubrium, all vertebrae, scarum, pelvis (fragmentary pubic symphysis).	*General:* all long bones (ulna no distal end, fragment radial shaft missing), 1st - 11th rib (from 3rd on no sternal ends); *Hand:* all metacarpals, all proximal phalanges, 3rd and 4th intermediate phalanges, 1st distal phalange; *Foot:* all tarsals, all metatarsals, 2 proximal phalanges and 1 intermediate phalange.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
C	I	A	A	A	A	A	A		A	A	A	P	A	A	I	C
	h															
					h											
P	A	A	A	A	I	P	P		P	P	P	P	I	A	A	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Most of the teeth have been lost ante-mortem.
- Calculus is present on the upper molars, on the lingual side for the 17 and on the labial side of the 27.
- An abscess and fistula is present at the location of 26 and 27-28 (both labial). The fistula at the location of 26 reaches the maxillary sinus.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests there was a metabolic upset around the age of 2,3 years and again around the age of 5 years.
- The tendons of the manubrium have also ossified. The xyphoid has also ossified.
- There is a cleft in the arch of the S1 (non-metric), and the basilar-occipital is not completely fused (which normally occurs during the age of 5-6 years).
- There are marginal osteophytes on the first sacral vertebral body, which might indicate possible DISH.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -1,42. The pelvis could be scored on all traits.
- The sexualization degree of the cranium is -0,6 and 87,5% could be scored. The sexualization degree of the mandible is -1 and could be scored on all traits. In total the skull has a sexualization degree of -0,75 and could be scored for 90,62%.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the pubic symphysis and the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase V and the spongiosa in the proximal end of the femur was in phase II. The spongiosa in the proximal end of the humerus was also in phase II, and the pubic symphysis was in phase IV. This gives an age-at-death at 63,5 years with an age range of 2,5 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase VIII (age-at-death: 60+).
- Using the Suchey-Brooks method, the pubic symphysis was in phase V (age-at-death: 27-66).

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser was used. The mean length of the femora and tibiae were used. This resulted in an ante-mortem stature of 159,7cm with a standard deviation of 3,55cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2422	1887	manubrium	green residue	29	20	2,95	0,126	6,79	0,043	0,114	1,40	40	61	1,22
2423	1887	manubrium	extra meting green residue	29	20	2,62	0,094	6,66	0,020	0,088	1,32	40	61	1,42
2424	1887	manubrium	achtergrond meting	30	17	2,91	0,269	21	0,170	0,434	3,68	24	56	0,242
5510	1887	sag.sut	green residue	32	27	1,45	0,104	13	0,063	0,214	3,82	22	54	0,366
5511	1887	temp/par/front L	green residue	38	28	0,975	0,045	4,46	0,027	0,067	1,65	27	55	0,48
5512	1887	temp/par/front R	green residue	35	25	1,67	0,067	4,41	0,025	0,044	1,63	33	58	0,634
5513	1887	temp/par/front L	extra meting green residue	30	24	1,08	0,087	16	0,142	0,392	4,03	23	54	0,572
5514	1887	parietal L	achtergrond meting voor geheel	40	31	1,93	0,322	8,01	0,06	0,134	3,38	16	50	0,375

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2422	141	21168	12153	5364	2118	263	186	3,75	22	3,45	527	47	92	47	43	58
2423	159	26172	12173	5073	2355	242	151	2,01	22	1,50	568	53	80	53	40	55
2424	119	22931	1537	822	397	246	148	5,27	48	3,30	86	45	91	45	42	54
5510	309	22932	12937	4244	319	31	104	1,84	22	215	91	1,5	5,77	24	49	32
5511	209	21211	9736	5434	259	31	81	1,84	22	224	71	1,5	21	25	48	30
5512	219	23219	14717	1775	1029	43	82	1,84	22	250	284	1,5	11	39	49	29
5513	242	17972	17391	5068	296	36	98	1,84	22	201	98	1,59	7,74	29	51	36
5514	354	23708	99	822	469	49	133	1,84	22	267	130	1,79	9,03	34	50	42

1927

OVERVIEW

Number:	1927	/ Crown number:	none
Reference number:	1927-V-VR		
Photo ID:	1457-1488		
Level (put/vlak/spoor):	5/7/37		

SUMMARY

Sex development:	FEMALE
Age-at-death:	50-59 years / used method: COMPLEX
Calculated stature:	160 cm ± 3,72cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue on both parietals (sagittal suture) and on the occipital (left)
Pathological & remarks:	DDD, cribra femora, vitamin D deficiency, abscess, torus maxillaris

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus (no distal end), radius, ulna, femur (no proximal end) with femoral head, tibia (no proximal and distal end), fibular shaft, 1st, 3rd - 8th ribs, 3 rib heads, 1 sternal rib end; *Hand:* 1st, 4th and 5th metacarpals, 1st, 2nd and 5th proximal phalanges, 5th intermediate phalange; *Foot:* 2nd metatarsal,	Frontal (fragmentary), both parietals (fragmentary), left temporal, fragments of the sphenoid, rest is fragmentary, both clavicles, medial side of left scapula, manubrium, right and left ilium and ischium.	*General:* humerus, radius, ulna (no distal end), femur (fragmentary distal end), tibia (no proximal or distal ends), fibula (no proximal or distal ends), 1st , 4th, 5th, 7th ribs, 1 shaft fragment, 1 sternal rib end; *Hand:* none; *Foot:* 4th metatarsal.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
M	M	M	M	M	M	M	M		P	I	P	A	A	I	P	P
														-5		
M	M	M	M	M	M	M	M		M	M	M	M	M	P	P	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- The inspected 22 shows fractures in the enamel.
- There is a peripheral abscess present in the tooth socket of 28.
- At the location of the 26-28 there is some slight torus maxillaris present (at an early stage).

PATHOLOGICAL/REMARKS

- There is some DDD present. On the L5, T11 and T12 there are Schmorl's nodes present on the superior vertebral body. The T10 has inferiorly marginal osteophytes. In addition to Schmorl's nodes, the T6 and the T8 are also slightly compressed.
- Cribra femora is present on the left femur.
- The left humerus and left tibia are slightly bowed (the humerus is bowed laterally). This would indicate rickets (adult rickets), though only slightly.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -1,16. In total 63,15% of the pelvis could be scored.
- The sexualization degree of the cranium could not be assessed because of fragmentary cranial bones.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the spongiosa in the proximal end of the femur and the humerus. These were both in phase III, bringing the age-at-death range to 50-59 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase V (age-at-death: 40-44).

ESTIMATION OF ANTE MORTEM STATURE

- The method for Trotter & Gleser was used. The length of the left femur was used. This resulted in a stature of 160cm with a standard deviation of 3,72m.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1578	1927	occipital	residue	37	26	1,49	0,149	16	0,104	0,267	4,31	15	50	0,553
1579	1927	occipital	extra meting residue	37	26	2,10	0,097	7,57	0,044	0,152	2,35	24	54	0,512
1580	1927	occipital	achtergrond meting	32	19	3,05	0,819	29	0,263	0,605	5,97	9,53	48	0,362
1581	1927	parietal	green residue	29	19	1,42	0,018	4,52	0,020	0,121	0,641	45	65	0,323
1582	1927	parietal	achtergrond meting	45	35	1,87	0,183	2,81	0,017	0,057	1,65	13	48	0,266
1583	1927	parietal	green residue	35	29	1,70	0,019	5,05	0,006	0,094	1,72	27	55	0,428
1584	1927	parietal	achtergrond meting	45	36	1,30	0,426	4,63	0,024	0,085	2,21	10	47	0,400

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1578	130	17408	4506	3364	345	289	94	1,84	24	2,10	100	26	76	26	46	32
1579	246	24212	5339	3493	275	302	106	1,84	22	2,10	76	23	91	23	47	28
1580	110	15688	284	1681	364	361	112	4,86	24	2,90	113	27	116	27	56	48
1581	139	17086	23438	4497	273	293	142	1,84	23	2,23	76	40	98	40	64	55
1582	402	21378	85	693	379	375	108	3,48	23	2,86	100	24	92	24	49	40
1583	308	32763	21171	4384	258	327	110	1,84	23	1,62	88	26	88	26	52	32
1584	425	32574	130	716	370	405	122	1,84	23	2,11	92	24	78	24	49	40

2009

OVERVIEW

Number:	2009	/ Crown number:	5918
Reference number:	2009-J-O		
Photo ID:	1410-1425		
Level (put/vlak/spoor):	5/8/72		

SUMMARY

Sex development:	INDETERMINABLE
Age-at-death:	12 – 16 years/ used method: fusions axial-epiphyseal/dental
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue is present on frontal (on forehead), left temporal, right ilium (on the iliac fossa)
Pathological & remarks:	cortical defect, lumbar vertebrae have fused – the thoracic vertebrae not, mandibular prognathism, enamel hypoplasia, caries, shovel-shaped incisor

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus, radius (no distal end) ulna, femur, tibia, poximal end fibula and fibular shaft, 2nd - 9th rib, 7 rib fragments; *Hand:* scaphoid, 4th and 5th metacarpals; *Foot:* talus, calcaneus, navicular, distal end 1st metatarsal, 2nd metatarsal with epiphysis, 3rd - 5th metatarsals, 4th - 5th proximal phalanges.	Facial part of the skull complete and intact (frontal, maxillae, zygomatics, sphenoid, nasals), parietals, occipital intact as well, mandible, both clavicles, lateral side right scapula, acromion process of left scapula, manubrium, C1-C3, C5-C7, all T vertebrae and all L vertebrae, left side of sacrum (S1-S3), right ilium, left ischium.	*General:* proximal end humerus, femur, distal end tibia and fibula, 1st and 2nd rib, 4 rib fragments; *Hand:* 4th metacarpal; *Foot:* calcaneus, intermediate cuneiform, 1st, 3rd (with epiphysis) and 5th (with epiphysis) metatarsals, 4th proximal phalange.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
P	I	I	I	I	I	I	I		I	I	I	A	I	I	I	I/U
					h				h	h				c		
					c					h	h	h	h/c	h		
I/U	P	P	I	I	I	I	I		I	I	I	I	I	I	P	I/U
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- The incisors are shovel shaped.
- Caries is present on 43 (occlusal-labial side), 35 (occlusal-buccal side) and on 35 there is a hole present on the mesial surface.
- While reconstructing the mandible and the maxillae, also noticing the wear on the lower canines and incisors (worn surface on mesial side of 43 and distal side of 42, because of 12), this individual has a mandibular prognathism.
- There is a slight overlap between 11 and 12. 12 is misaligned and is anteriorly to 11.
- On all incisors and canines there is some slight dental wear.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia on the incisors, the canines and the first molar suggests there was a metabolic upset around the age of 2-3 years.
- A cortical defect is present on the right clavicle.
- Though the neuro-central junction is still fusing in the thoracic vertebrae, this has already fused in the lumbar vertebrae.

SEX ASSESSMENT

- Not possible due to age, the sex traits are indifferent.

SKELETAL AGE ASSESSMENT

- Age-at-death of the individual based on dental eruption and mineralization was placed at 15 years, with an age interval of 36 months.
- Based on closures and fusions of the axial skeleton, the individual was between 5 and 17 years. The basilar part to the occipital bone has already fused (age: > 5 years). The acetabulum is unfused, which would mean the individual is younger than 17 years.
- With the epiphyseal fusions the age range could be narrowed down. The estimated age has not been corrected for sex, as the sex was not possible to determine. The proximal end of the ulna is fusing, which would mean an age of 12-16 years. All other epiphyseal fusions correspond with this.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1509	2009	frontal	green residue	28	21	2,34	0,074	3,40	0,003	0,083	1,07	44	60	1,39
1510	2009	frontal	achtergrond meting	41	26	0,864	0,019	3,89	0,012	0,079	1,05	27	57	0,170
1511	2009	pelvis	green residue	14	5,48	2,21	0,051	6,35	0,094	0,281	0,569	71	80	0,416
1512	2009	pelvis	achtergrond meting (posterior)	42	31	1,15	0,261	3,06	0,018	0,068	2,24	20	52	0,504
5555	2009	temp L	green residue	19	9,32	3	0,069	10	0,116	0,417	1,22	56	72	0,208
5556	2009	temp L mast	achtergrond meting	33	25	2,71	0,15	13	0,11	0,336	2,53	22	55	0,202

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1509	244	16458	44811	4754	184	300	97	1,84	22	1,50	61	24	89	24	45	37
1510	166	29300	52	227	30	341	163	3,72	24	3,45	9,97	47	89	47	66	39
1511	126	13512	16484	4020	636	229	149	3,55	25	3,25	149	44	151	44	93	82
1512	213	29183	47	862	419	360	122	5,99	24	2,68	85	25	78	25	51	37
5555	74	9910	15296	3555	245	47	209	2,71	24	249	71	2,48	8,44	54	71	48
5556	103	15957	513	1229	306	33	104	6,28	32	276	59	1,72	6,53	30	56	34

2243

OVERVIEW

Number:	2243 / Crown number: none
Reference number:	2243-K-O
Photo ID:	1629-1655
Level (put/vlak/spoor):	6/1/43

SUMMARY

Sex development:	INDETERMINABLE
Age-at-death:	3 years ±12 months / used method: dental
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue is present above the left orbit, on the superior side of the right temporal and posteriorly on left parietal
Pathological & remarks:	cribra orbitalia, enamel hypoplasia, caries, cusp of Carabelli, very fragmented individual

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humeral shaft, radius (proximal end), ulna (no distal end), 1st rib, 6 rib shafts, 2 rib fragments; *Hand:* none; *Foot:* none.	Fragments posterior part parietals, fragment superior part occipital, both temporals (fragmentary), basilar part with right condyle, fragments of orbits, sphenoid, mandible, fragments of lateral scapulae, right clavicle, C1, arches of C and T vertebrae, fragments of vertebral bodies, right ilium.	*General:* fragment 2nd rib, 9 rib shafts, 1 rib fragment; *Hand:* none; *Foot:* none.

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			P	P	I	I	I		I	M	M	M	I			
					$A^{1/2}$	Ac	Ac		Ac				$R^{3/4}$			

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
		U														
		h / R^1														
		U												U		
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

				c / h	$A^{1/2}$	Ac	$A^{1/2}$		Ac	$A^{1/2}$						
			I	I	I	I	I		P	I	I	P	I			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

- Of the other inspected mandibular teeth the development status of root or crown development could not be analysed, for the teeth were still in the mandible.
- In the mandible there are two crypts present for the second permanent molars.
- The deciduous teeth show slight wear and caries is present on the labial surface of 84 and the occlusal surface of 75. The caries on the 84 is possibly on the same location as the present hypoplasia.
- The permanent first molar present has an extra cusp: cusp of Carabelli.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests a metabolic upset during birth (deciduous right first lower molar) and around the age of 2,7-3,0 years (permanent right first upper molar).
- Cribra orbitalia is also present, also indicating stress of health.

SEX ASSESSMENT

- Not possible due to age.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed at 2-3 years with an age interval of 18 months. Based on the root development of the permanent first molar, the age-at-death is 3 years with an age interval of 12 months.
- The fusions and closures of the axial skeleton correspond with the above age range. The neuro-central junction was still open, which would mean the individual is younger than 6. The halves of the neural arches have fused, so an age of older than 1 year is possible. Also, in the sphenoid, the central part has fused with the greater wings (this happens during the first year) but the foramen of Huschke is still open (which fuses around the age of 5 years).

ESTIMATION OF ANTE MORTEM STATURE

– Not possible due to age.

DESCRIPTION ARTEFACTS

– Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1577	2243	vertebra body	green residue geen achtergrond meting mogelijk	34	27	1,48	0,045	5,34	0,007	0,097	1,05	30	49	2,75
1585	2243	mandible	green residue	18	10	1,03	0,024	1,16	-0,001	0,054	0,597	69	78	0,741
1586	2243	mandible	achtergrond meting	34	22	3,35	0,339	24	0,217	0,483	4,82	10	48	0,357
1587	2243	parietal	green residue	38	29	1,57	0,065	11	0,055	0,185	2,49	17	51	0,340
1588	2243	parietal	achtergrond meting	54	41	2,13	0,091	4,36	0,038	0,107	1,81	-3,496	38	0,331
1589	2243	frontal	green residue	28	26	5,06	0,112	2,57	0,018	0,084	0,909	37	58	0,743
1590	2243	frontal	achtergrond meting	60	42	0,589	0,046	4,49	0,031	0,109	1,37	-9,444	34	0,289
1591	2243	parietal	green residue	33	26	3,47	0,081	5,15	0,006	0,081	1,64	31	54	0,430
1592	2243	parietal	achtergrond meting	41	34	2,89	0,074	3,02	0,080	0,064	1,46	17	51	0,336
1593	2243	frontal-orbit	green residue	29	25	2,98	0,085	5,84	0,013	0,141	1,26	36	60	0,242
1594	2243	frontal-orbit	achtergrond meting	37	26	2,44	0,244	13	0,102	0,279	2,97	17	51	0,284
1595	2243	zygomatic	green residue	26	23	5,12	0,115	4,62	0,007	0,108	1,07	40	61	0,848
1596	2243	zygomatic	achtergrond meting	33	24	4,42	0,190	12	0,079	0,257	2,59	23	53	0,655

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1577	1786	24552	65341	11764	10299	282	94	13	24	3,55	2212	28	91	28	56	33
1585	125	18712	19418	5510	1973	194	174	2,61	25	3,37	458	51	114	51	95	156
1586	277	24989	238	650	427	304	77	3,07	40	2,77	106	24	119	24	48	27
1587	914	22903	8828	435	266	260	71	1,84	22	1,50	87	21	79	21	43	26
1588	1047	29821	224	684	501	274	85	1,84	23	4,62	123	27	118	27	58	31
1589	619	27483	42320	7341	285	324	100	1,84	23	2,25	108	25	138	25	50	30
1590	1827	53739	126	192	43	252	94	1,84	26	7,19	12	42	77	42	71	35
1591	599	18551	21434	5505	119	295	75	1,84	22	1,50	40	36	111	36	45	27
1592	744	21609	201	1099	332	299	99	1,84	22	2,24	92	25	106	25	46	26
1593	513	20706	25542	5512	61	253	116	1,84	24	2,21	19	34	136	34	66	42
1594	561	20468	259	427	182	283	77	1,94	23	4,01	55	23	108	23	49	28
1595	400	18392	30526	5686	229	312	98	1,84	22	1,50	67	23	128	23	47	29
1596	344	19519	9548	7075	264	364	84	1,84	23	2,69	94	32	143	32	53	30

2278

OVERVIEW

Number:	2278	/ Crown number: none
Reference number:	2278-K-O	
Photo ID:	1656-1671	
Level (put/vlak/spoor):	6/2/51	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	8 years ±24 months	/ used method: dental/fusions axial
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue is present on the left temporal-parietal and on the left parietal (close to coronal suture)	
Pathological & remarks:	skeletal age is "younger" than dental age, enamel hypoplasia, vitamin D deficiency	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: proximal humerus epiphysis, femur (with all epiphyses), tibia (with all epiphyses), fibula (no distal end, no epiphyses), 1st and 2nd rib fragments, 1 rib fragment; *Hand:* 4 proximal phalanges, 2 intermediate phalanges; *Foot:* talus, calcaneus, navicular, cuboid, lateral and medial cuneiform, all metatarsals, 1st proximal and distal phalanges.	Large fragments of occipital and right parietal, fragment of left parietal and occipital, fragment of frontal-right parietal, fragments of frontal, right temporal, left petrous pyramid, fragment right orbit, right zygomatic, sphenoid, mandible, C1-C7, T1-T3, 3 vertebral T bodies (fragmentary), both clavicles, lateral sides of scapulae, left and right ischium.	*General:* humerus (no distal end), femur (with all epiphyses), tibia (with all epiphyses), fibula (no epiphyses), 1st and 2nd rib fragments, 2 rib head fragments; *Hand:* 1st, 4th and 5th metacarpal, 2 proximal phalanges, 1 distal phalange; *Foot:* talus, fragment of calcaneus, navicular, lateral cuneiform, all metatarsals, 1st proximal and distal phalanges, 2 proximal phalanges.

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			I	I	P		M		M	M		M	I			

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
U/P	U	I	U	U	U	I	P		P	U/P	I	I	I	I	I	U/P
											$R^{1/4}$			A^{1}	$R^{1/4}$/ h	
						$R^{1/4}$	A^{1}		A^{1}	$R^{1/4}$						
U	U	P	U	U	U	I	I		I	I	U	U	U	P	U	U
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

			I	I	I						P	I	P			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

- In the mandible, the sockets for the M1 are present but are lost post-mortem. The sockets for the M2 are also already present.
- In the maxilla, on the right side there is a crypt for the M2 present but no tooth. The M2 on the other side has developed and is visible.
- 54 has some slight dental wear and 83 has its occlusal surface chipped off. Caries is present on the distal surface of 54.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia lines (on both upper first molars) suggest there was a metabolic upset around 2,7-2,9 years.
- A vitamin D deficiency is visible, as both femora are slightly bowed anterior-laterally.
- In the right and left clavicle there is a cortical defect.

SEX ASSESSMENT

- Not possible due to age. The mandible, however, has some female indications.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed at 8 years with an age interval of 24 months. The root development of the permanent teeth correspond with this. The root development of the canine as well as the first molar suggest an age of 4 ½ to 7 years. The root development of the second molar suggest an of 6-8 years.
- The fusions and closures of the axial skeleton do not completely correspond with the above age range. The neuro-central junction was fusing (also visible in the atlas, which indicates an age of 5-6 years), which suggests an age of 3-6 years. The basilar part to the occipital bone was already fused, which would indicate an age of older than 5 years. Of the long bones present, none of the epiphyses were fused or fusing.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4673	2278	skullfrag	green residue	26	23	2,75	0,252	6,74	0,017	0,145	2,76	38	59	1,73
4674	2278	skullfrag	achtergrond meting	31	24	2,99	0,245	12	0,093	0,271	2,82	27	57	0,639
4675	2278	skullfrag	green residue geen achtergrond meting mogelijk	35	31	0,805	0,103	1,97	0,036	0,074	1,68	29	57	0,716
4676	2278	skullfrag	green residue geen achtergrond meting mogelijk	25	23	1,13	0,065	4,14	0,138	0,091	1,83	45	67	0,814

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4673	803	18831	14938	5532	2410	51	143	1,84	22	242	706	1,5	13	41	50	84
4674	313	17936	377	1180	1368	67	257	3,67	22	245	340	1,5	10	40	55	80
4675	1104	26114	3052	2027	426	50	143	1,84	21	216	131	1,5	5,81	39	49	50
4676	576	15768	1853	1890	649	45	126	1,84	21	150	209	1,5	6,38	45	44	46

2366

OVERVIEW

Number:	2366	/ Crown number:	none
Reference number:	2366-V-VR		
Photo ID:	2050-2070		
Level (put/vlak/spoor):	6/4/63		

SUMMARY

Sex development:	FEMALE
Age-at-death:	37 - 40 years / used method: COMPLEX
Calculated stature:	167,72cm ± 3,72cm / used method: Trotter & Gleser (fem.)
Artefacts/crown/ residue on bone:	green residue on left parietal and left temporalis suture, green residue on the lateral side of the right calcaneus
Pathological & remarks:	chipped upper teeth, periodontitis, calculus, enamel hypoplasia, torus palatinus, foramen Huschke, periositis on femora, slightly DISH present, DDD in cervical vertebrae, VOA in high thoracic vertebrae

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humerus (no anatomical neck, fragment humeral head present), femur, tibia, 2nd - 12th rib heads; *Hand:* 2nd - 5th metacarpals, 1st - 4th proximal phalanges, 2nd - 4th intermediate phalanges, 1 distal phalange; *Foot:* all tarsals, all metatarsals, 1 proximal phalange.	Frontal, maxillae, zygomatics and partial left parietal intact and articulated, mandible, fragment of left and right temporal, fragment of left parietal, fragments of occipital, lateral sides of scapulae, C1, C2, T arches, L fragments, S1 (right side missing) plus sacrum fragments, left and right ilium (only fragmentary iliac crest) with acetabulum and partial ischium, Indeterminable: 1 distal hand phalange.	*General:* humerus (no lateral-proximal end), radius, ulna (no distal end), femur, proximal end and tibial shaft, distal-lateral end tibia, distal end and proximal fibular shaft, 9 rib heads; *Hand:* capitate, 2nd and 3rd metacarpal, all proximal phalanges, 2nd, 3rd and 5th intermediate phalanges, 1st distal phalange; *Foot:* fragment of talus and calcaneus, proximal ends of 3rd - 5th metatarsals, 1st distal phalange.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
C	P	I	I	I	I	I	I		I	I	I	I	I	P	P	C
		3					h		h							
	3-	3+														
C	I	I	I	I	I	I	I		I	I	P	I	I	A	P	C
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Dental wear is severe on most of the molars, premolars and canines. The dental wear between 34 and 35 forms a gap, possibly because of the presence of 25. Dental wear is only slightly present on the 21 and 22.
- The jaw could be reconstructed, and it appears there is a slight maxillary prognathism.
- Calculus is present on the lingual and labial side of the lower incisors, and between the upper premolars and canine.
- Periodontitis is present.
- The upper incisors and canines are chipped.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests there was a metabolic upset around the age of 2 years.
- Marginal osteophytes are present in the left shoulder joint, but POA is not present. This is the same for the left knee (medial).
- Periostitis is present on both femora. The new bone formation is located distally, on the posterior surface, and is sclerotic and diffuse.
- There is some ossification of the muscle attachments of the femur and the calcaneus; which might be related to DISH.
- Torus palatinus is present, and also the foramen of Huscke (only on the left side).
- Marginal osteophytes are present between the dens of the axis and the atlanto-axial joint. Between the C6 and C7 there are also marginal osteophytes and erosion present on the vertebral body. Between the T3-T5 there is erosion present, on the right articular facets. Between the T10 and T11 marginal osteophytes are present on the left articular facets. The T12 has marginal osteophytes on the superior surface of the vertebral body (right side). On the L5, marginal osteophytes are present on the superior and inferior surface of the vertebral body (left side), and the first sacral vertebral body has also marginal osteophytes and a Schmorl's node. In conclusion, DDD is present in the cervical vertebrae, and VOA is present in the high thoracic vertebrae.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -0,6. In total 63,15% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,09 and in total 45,83% could be scored. The sexualization degree of the mandible is +0,625 and could be scored on all traits. In total the skull has a sexualization degree of +0,47 and 59,37% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the spongiosa in the proximal end of the femur and the endocranial suture obliteration. The spongiosa in the proximal end of the femur was in phase III, the endocranial suture obliteration was in phase I. This gives an age-at-death between 37 - 46 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase III (age-at-death: 30-34).

ESTIMATION OF ANTE MORTEM STATURE

- Not determined due to indeterminable sex.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2425	2366	calcaneus R	green residue	30	17	0,958	0,126	2,81	0,025	0,062	0,679	48	64	0,231
2426	2366	calcaneus R	achtergrond meting	34	20	0,790	0,015	9,21	0,052	0,157	1,86	34	60	0,498
5536	2366	hu R dist ant	iron residue / niet complete meting?	11	13	27	0,099	18	0,078	0,343	2,53	27	55	0,184
5537	2366	hu R dist post	iron residue	16	12	17	0,033	18	0,096	0,343	2,68	34	60	0,184
5538	2366	hu R shaft post	achtergrond meting	38	29	1,35	0,111	2,18	0,01	0,037	1,16	28	56	0,373
5557	2366	par L	green residue	34	22	1,18	0,057	5,45	0,036	0,085	0,917	37	60	0,315
5558	2366	par L suture	extra meting green residue	9,83	8,21	6,39	0,089	34	0,058	0,233	1,57	39	68	0,138
5559	2366	par L	achtergrond meting	32	22	3,37	0,491	21	0,154	0,422	4,17	16	51	0,194
5560	2366	temp frag	green residue (geen achtergrond meting mogelijk)	30	25	3,31	0,046	4,23	0,008	0,086	1,09	36	58	0,945

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2425	121	28931	53227	174	124	226	173	2,01	24	2,30	44	51	60	51	47	81
2426	198	22084	105	301	315	213	140	1,84	22	1,50	83	42	47	42	36	69
5536	130	11170	167	715	254	72	384	4,42	37	257	70	2,1	7,17	34	96	87
5537	288	10316	111	698	169	42	183	1,84	24	295	63	1,55	5,24	32	54	60
5538	713	14994	55	1009	179	34	108	1,84	22	233	51	1,5	4,41	32	48	47
5557	688	14276	10269	2823	55	55	87	1,84	22	182	21	1,63	4,34	34	51	32
5558	516	45910	1855	361	92	156	380	11	35	142	52	12	20	145	411	371
5559	263	13233	356	1580	221	52	115	4,98	25	300	59	1,5	5,23	33	50	49
5560	650	14024	25355	7286	1835	41	87	1,84	22	294	421	1,5	12	39	49	36

2403

OVERVIEW

Number:	2403	/ Crown number:	none
Reference number:	2403-V-VR		
Photo ID:	1989-2011		
Level (put/vlak/spoor):	6/5/76		

SUMMARY

Sex development:	FEMALE
Age-at-death:	20 – 30 years / used method: fusions/COMPLEX/aur.sur
Calculated stature:	167,48cm ± 3,51cm / used method: Trotter & Gleser (f/t/h)
Artefacts/crown/ residue on bone:	green residue on posterior side mentum, on the C7-T1 and on the L2 and L5
Pathological & remarks:	impacted canine, enamel hypoplasia, caries, calculus, healed fracture right distal ulna, slight scoliosis in L vertebrae, caudal shift, maxillary sinusitis, bowed right femur

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus, radius, ulna, femur, tibia, 2nd - 7th and 9th - 11th ribs; *Hand:* none; *Foot:* 2nd and 5th metatarsal.	Fragments of frontal with nasal bones, fragments of posterior parietals, fragments of occipital, mandible, both zygomatics, right maxilla, inferior occipital-sphenoid, both temporals (fragmentary), right clavicle, lateral side right scapula, sternum, all vertebrae, sacrum, right pelvis (fragmentary).	*General:* distal shaft and end radius, 1st rib; *Hand:* 2nd - 5th metacarpals, 3rd proximal phalange, 5th intermediate phalange; *Foot:* none;

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
A	I	I	I	I	I	I	I		I	I	I	I	I	M	I	I
	2	3+	h	h		h				h		h	h / c		2- / h	h
		5+ / h	h	h	h						h	h	h			
M	M	I	I	I	I	I	I		I	I	I	I	I	P	P	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

– The socket for the 13 is closed, but the tooth is present superior to 12. It is an impacted canine. The upper right first premolar is misaligned.

- The third molars show almost no sign of dental wear. The rest of the molars have some dental wear, with the 46 showing a dental attrition of 5-.
- Calculus is present on the labial side of the incisors and the canines (upper and lower).
- The upper medial incisors are morphologically different; they are relatively large.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests there was a metabolic upset around the age of 3 years, again around the age of 4 years and 5 years, as well as around the age of 11 years.
- The distal end of the right radius is bent laterally, this is a healed fracture. The right radius is however not bent and does not appear to have a healed fracture.
- The acetabulum is shallow, when compared to the relatively large femoral head.
- The right femur is slightly bent laterally at the proximal end.
- The T1 is morphological similar to a cervical vertebra, indicating a caudal shift. On the anterior vertebral surface of the T1-T7 are venous impressions present.The T7-T12 are codfish shaped, and in the lower thoracic vertebrae (T10-T12) is a slight scoliosis present. In addition to this, the L1 is compressed on the left side, and the L4 is compressed on the right side.
- Maxillary sinusitis is present on the right side. The new bone formation is lamellae and sclerotic, and this is diffuse. The left side is missing and could therefore not be inspected.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -0,84. In total 68,42% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,07, and in total 58,33% could be scored. The sexualization degree of the mandible is -0,5 and could be scored on all traits. In total the skull has a sexualization degree of -0,1 and 68,75% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the pubic symphysis (though fragmented). The endocranial suture obliteration was in phase I, and the pubic symphysis was in phase II. This gives an age-at-death between 26-35 years. Using only the endocranial suture obliteration, the age-at-death is placed between 23-40 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase III (age-at-death: 30-34).
- The age method of the sternal rib end could also be used. This came close to phase IV (age-at-death: 24-31).
- The right jugular synchondrosis is fused, the left is still unfused. This indicates an age between 22-34 years.

ESTIMATION OF ANTE MORTEM STATURE

- Only the method from Trotter & Gleser could be used. Both the length of the right femur, as well as a combination of measurements (femur, humerus, and tibia) were used to estimate the ante mortem stature. Using only the measurement of the femur, this resulted in a stature of 166,73cm with a standard deviation of 3,72cm. Using a combination of measuremens as mentioned above, this resulted in a stature of 167,48cm with a standard deviation of 3,51cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2458	2403	mandible	green residue	22	19	1,60	0,087	10	0,015	0,198	1,54	45	65	0,627
2459	2403	mandible	achtergrond meting	34	22	2,67	0,185	11	0,049	0,223	1,81	28	57	0,253
2460	2403	T1	green residue	29	24	2,43	0,075	6,87	0,027	0,120	2,03	36	55	1,09
2461	2403	T1	achtergrond meting	17	12	2,65	0,257	46	0,269	0,835	5,21	16	55	0,243
2462	2403	C7	green residue	34	26	1,23	0,069	12	0,069	0,194	2,45	24	54	0,490
2463	2403	C7	extra meting green residue	34	25	1,30	0,066	12	0,066	0,196	2,14	25	55	0,463
2464	2403	C7	achtergrond meting	21	11	2,83	0,439	37	0,303	0,841	4,15	22	56	0,253
2465	2403	L vert hoog	green residue	28	18	2,37	0,116	13	0,054	0,238	1,93	36	62	0,251
2466	2403	L vert hoog	extra meting green residue	32	21	1,95	0,106	12	0,062	0,191	1,45	30	58	0,246
2467	2403	L vert hoog	achtergrond meting	15	9,50	3,20	0,202	49	0,316	0,947	3,82	18	56	0,226
2468	2403	L vert laag	green residue	32	22	2,47	0,147	6,72	0,041	0,091	1,47	34	59	0,308
2469	2403	L vert laag	achtergrond meting	27	17	2,08	0,284	24	0,223	0,510	3,25	26	57	0,285

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2458	685	18701	30107	3590	1083	218	360	1,84	22	1,50	195	61	70	61	65	132
2459	186	20605	81	541	243	330	154	1,84	22	1,50	69	67	79	67	39	67
2460	319	22267	46173	7330	1249	314	157	2,27	21	1,50	270	37	63	37	31	69
2461	81	11709	128	557	687	245	225	22	88	2,14	91	41	76	41	38	61
2462	205	23134	7444	4208	224	257	222	1,84	23	1,50	49	56	54	56	36	54
2463	145	34131	6086	4311	249	261	156	1,84	24	1,50	52	41	51	41	32	46
2464	96	14020	139	625	572	285	208	8,77	60	1,77	134	48	77	48	36	48
2465	124	31903	4172	2536	436	250	190	4,16	41	1,50	62	61	86	61	47	94
2466	140	23659	5754	2608	401	261	206	4,35	38	1,62	51	56	87	56	53	74
2467	94	12235	228	958	646	228	159	20	104	3,21	92	45	82	45	36	50
2468	242	21353	23153	757	417	267	146	1,84	21	1,51	106	49	72	49	35	53
2469	124	19340	99	602	580	302	180	7,05	54	2,80	123	51	78	51	46	109

2611

OVERVIEW

Number:	2611	/ Crown number: none
Reference number:	2611-K-O	
Photo ID:	1708-1723	
Level (put/vlak/spoor):	6/9/136	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	9 years ±24 months	/ used method: dental/fusions axial
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue is present on the frontal (above right orbit)	
Pathological & remarks:	skeletal age is “younger” than dental age, very fragmented	

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humeral shaft, ulna (proximal end), femoral shaft and femoral head, 3 rib fragments; *Hand:* none; *Foot:* none;	Fragment frontal-orbit, fragment right parietal, fragment right and left temporal, lateral sides of mandible, both clavicles (no medial end), lateral sides of scapulae, manubrium, 28 vertebral bodies, fragments of neural arches, S1, right and left ilium (inferior side), right and left ischium (fragmentary), right and left pubis (fragment of acetabulum), indeterminable long bones, and hand/foot bones.	*General:* humeral shaft, distal fragment humerus, femur (shaft and proximal end), tibial shaft; *Hand:* none; *Foot:* none.

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			M	M	M	M	M		M	M	M	M	M			

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	M	M	M	I	M	M	M		M	M	M	M	M	I	I	M
				$R^{1/2}$										$R^{1/2}$	$R^{1/4}$	
	$R^{1/4}$				$R^{1/2}$					h / $R^{3/4}$	$R^{1/2}$	-		$R^{3/4}$	$R^{1/4}$	
U	I/U	P	M	M	I	M	M		M	I	I	I/U	U	I	I	M
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

			M	M	M	M	M		M	M	M	I	I			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

- There is some slight dental wear on the deciduous molars. They also have on their interproximal contact facets some caries.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia (on the left lower lateral incisor) indicates there was a metabolic upset around the age of 1-1,3 years.

SEX ASSESSMENT

- Not possible due to age.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed at 9 years with an age interval of 24 months. The root development of the permanent teeth correspond with this. The root development of the first premolar, canine and second molar all suggest an age between 6-10 years.
- The fusions and closures of the axial skeleton do not completely correspond with the above age range. The neuro-central junction was fusing, which suggests an age of 3-6 years.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1575	2611	frontal	green residue	32	28	2,30	0,189	10	0,024	0,155	2,83	25	55	0,300
1576	2611	frontal, R sup corner	achtergrond meting	39	30	2,69	0,538	12	0,060	0,215	2,78	13	49	0,156

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1575	288	24940	20192	282	239	229	77	1,84	22	1,50	56	23	94	23	47	28
1576	327	28120	145	359	203	263	120	2,66	22	2,29	36	25	112	25	52	31

3087

OVERVIEW

Number:	3087	/ Crown number:	none
Reference number:	3087-V-M		
Photo ID:	2093-2112		
Level (put/vlak/spoor):	13/1/1		

SUMMARY

Sex development:	MALE
Age-at-death:	20-25 years / used method: fusions axial
Calculated stature:	167,55cm ± 3,27cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue on the anterior sides of L3-L4, on both the auricular surfaces, sternum, on the right sphenoid (also with a concentration of corrosion material), left nasal-orbit-maxilla area, and on the left maxilla are fragments of glass still present
Pathological & remarks:	very eroded, congenitally absent M3's, enamel hypoplasia, pipe notches, endocranial new bone formation frontal (tuberculosis?), Scheuermann's disease (Schmorl's nodes), lumbarization of the S1

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humerus (no proximal or distal end), radius (no proximal or distal end), ulna (no proximal or distal end), femur (missing distal shaft fragment), tibia (no distal end), 8 rib shaft fragments; *Hand:* scaphoid, trapezoid; *Foot:* none.	Frontal-orbit (left and right, fragmentary), nasal, right and left zygomatic and maxillae, mandible, left and right parietals, superior side occipital, both temporals, fragments of sphenoid, right lateral side scapula, C1-C3, C5-C7 (fragmentary), T1-T12, (fragmentary) L1-L5 (fragmentary), sacrum (eroded), left and right ilium with acetabulum and partial ischium, on left side iliac crest present, Indeterminable: 2 intermediate hand phalanges, 1 fragment fibular shaft.	*General:* distal humeral shaft, proximal ulnar fragment, femur, proximal tibia and tibial shaft, 4 rib shaft fragments; *Hand:* none; *Foot:* none.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
C	I	I	I	I	I	I	I		I	I	I	I	I	I	I	C
		2-	h	h	h	h	h		h	h	h	h	h	h / 2-		
				h	h	h				h	h	h				
C	I	P	I	I	I	I	I		I	I	I	I	I	P	P	C
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Calculus is present between the lower first and second incisors.
- Some slight dental wear. Between the lateral incisor and the canine – upper as lower, on the right and left side – a gap is present, which is a pipe notch. There is another pipe notch – upper and lower, left and right - between the canine and the first premolar.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests there was a metabolic upset around the age of 3-4 years (with an age interval of 12 months).
- There is new bone formation on the endocranial surface of the frontal, which might be an indication of tuberculosis.
- Schmorl's nodes are present on the lower thoracic vertebrae (T5-T12), on the superior as well as inferior surfaces of the vertebral body. On the T6, there is hypervascularization on the vertebral body. Some of the vertebrae are slightly wedged, and the L5 has a codfish compression. The lumbar vertebrae have also Schmorl's nodes, as well as the superior surface of the S1. The Schmorl's nodes might indicate Scheuermann's disease.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +0,14. In total 73,68% of the pelvis could be scored.
- The sexualization degree of the cranium is +1. In total 29,16% of the cranium could be scored. The sexualization degree of the mandible is +0,125 and could be scored on all traits. In total the skull has a sexualization degree of +0,53 and in total 46,87% could be scored.

SKELETAL AGE ASSESSMENT

- Based on several fusions it was possible to determine the age-at-death. The sternebrae have fused, which would mean an age of over 14 years. The annular vertebral endplates were open and fusing (the C vertebrae were closed), which would put the age between 18 and 25 years. The sacral vertebral bodies were fused. Age would be then between 20-25 years. Also, the iliac crest was still fusing, which indicates an age between 14-24 years. Taking all of these age ranges into account, the definite age range has been placed between 20-25 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase I (age-at-death: 20-24).

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. The length of the left femur was used in both methods. With Breitinger, this resulted in a stature of 167,67cm with a standard deviation of 5,4cm. With the method from Trotter & Gleser this was 167,55cm with a standard deviation of 3,27cm.

DESCRIPTION ARTEFACTS

- Besides the green residue, fragments of glass were found. These were still embedded in the soil present on the left maxilla.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2427	3087	L4	green residue	33	27	2,80	0,105	4,32	0,043	0,105	0,647	33	59	0,134
2428	3087	L4	extra meting green residue	36	31	2,48	0,141	3,11	0,022	0,097	0,702	27	56	0,084
2429	3087	L4	achtergrond meting	35	29	2,31	0,135	14	0,081	0,229	1,92	17	52	0,251
2430	3087	L3	green residue	40	32	2,09	0,115	2,46	0,025	0,066	0,858	23	53	0,100
2431	3087	L3	achtergrond meting	34	25	2,67	0,032	27	0,169	0,401	3,43	7,41	47	0,161
2432	3087	sternum frag	green residue	25	21	3,15	0,020	7,57	0,030	0,178	1,69	42	63	0,180
2433	3087	sternum frag	achtergrond meting	47	41	3,56	0,088	2,55	0,064	0,116	2,08	3,91	40	0,218
2434	3087	maxilla L	green residue	21	17	6,13	0,035	8,56	0,019	0,230	1,74	45	63	1,55
2435	3087	maxilla L	achtergrond meting	39	32	0,621	0,054	7,03	0,023	0,129	2,29	19	52	0,360
3465	3087	sphenoid-temporal R	green residue with iron residue	10	9,46	1,9	0,012	25	0,129	0,515	1,43	51	70	0,525
3466	3087	sphenoid-temporal R	green residue beside iron residue	28	21	1,74	0,014	4,87	0,015	0,103	1,13	43	62	0,236
3467	3087	sphenoid-temporal R	achtergrond meting	23	12	3,69	0,228	6,71	0,051	0,177	0,547	53	71	0,089
3485	3087	pelvis L	green residue	28	20	3,04	0,018	9,88	0,065	0,257	1,5	37	60	0,326
3486	3087	pelvis L	achtergrond meting	37	31	2,42	0,013	11	0,107	0,276	2,88	15	51	0,301
5532	3087	ilium R	green residue	36	24	2,62	0,117	3,02	0,025	0,1	0,428	34	59	0,085
5533	3087	ilium R post	achtergrond meting	19	16	4,18	0,323	41	0,329	1,01	5,79	13	52	0,322

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2427	205	26120	5196	1785	52	208	136	1,84	22	1,50	7,76	37	74	37	33	53
2428	369	25178	12862	2924	92	230	172	2,83	21	1,50	7,46	37	69	37	33	69
2429	248	22523	296	1156	199	204	163	3,67	25	1,50	47	38	66	38	33	49
2430	423	23416	12657	2671	83	219	134	2,18	23	1,50	9,65	39	65	39	33	50
2431	170	22744	200	771	95	188	136	4,40	26	1,50	15	39	75	39	34	50
2432	97	17858	27850	4737	546	252	142	5,36	23	1,50	28	42	81	42	36	67
2433	549	35988	1199	2132	113	264	157	2,25	26	3,99	19	37	87	37	35	42
2434	270	16762	20063	3986	2007	279	130	1,84	21	1,50	577	39	98	39	33	47
2435	472	23507	961	519	211	175	111	1,84	21	1,50	63	32	37	32	30	41
3465	1937	6737	35918	1929	169	57	188	12	75	117	37	1,5	4,23	40	40	62
3466	799	12874	24603	7110	54	58	139	1,84	21	197	20	1,5	3,08	42	39	52
3467	82	12575	226	981	188	75	207	5,8	47	232	55	2,05	6,83	63	66	136
3485	857	15184	30155	4152	385	58	145	1,84	21	188	133	1,5	5,53	70	44	87
3486	414	22672	59	749	224	45	157	1,84	21	180	65	1,5	3,85	40	38	73
5532	193	13771	7126	2588	111	40	82	5,75	29	221	13	2,27	4,95	24	54	30
5533	53	9166	190	665	202	34	113	5,61	28	204	68	1,5	5,23	25	53	43

3290

OVERVIEW

Number:	3290 / Crown number: none
Reference number:	3290-K-O
Photo ID:	1724-1735
Level (put/vlak/spoor):	16/2/11

SUMMARY

Sex development:	INDETERMINABLE
Age-at-death:	8 yrs ±24 months/used method: long bone length (recons.)
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue is present on the inside of the skull (indeterminable skull fragment), possible fragment of glass
Pathological & remarks:	very fragmented individual, not many age indicators present, chronic meningitis (occipital and frontal) –possibly tuberculosis related

SKELETON STATUS

Present:

Right	General/Skull	Left
General: distal humeral shaft, femoral head epiphysis, proximal end tibia, 5 rib fragments; *Hand:* none; *Foot:* 4 fragments;	Occipital with fragmentary parietals, fragment of right temporal, 1 fragment of scapula, 1 fragment of a vertebral body, 4 fragments neural arches, right and left ilium (fragmentary), left ischium; Indeterminable: 2 fragments radial shaft, ulnar shaft, 2 fragments humeral shaft, distal epiphysis tibia, 2 fragments of diaphysis of the leg.	*General:* lateral epicondyle of humerus, femur (proximal end, distal end with shaft fragment and proximal/distal epiphysis), proximal end tibia and tibial shaft, 3 rib fragments; *Hand:* none; *Foot:* 2 fragments.

DENTAL

			55	54	53	52	51		61	62	63	64	65			

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38

			85	84	83	82	81		71	72	73	74	75			

- Only the permanent upper left incisor is present and is NOT from this individual. Its root has broken off, making it not possible to analyse how far exactly the root development was. The tooth does show signs of some dental wear, which would indicate it had erupted.

PATHOLOGICAL/REMARKS

- Symptoms of chronic meningitis are visible on the ectocranial surface of the frontal and the occipital bone. They might be tuberculosis related.

SEX ASSESSMENT

- Not possible due to age. Though the pelvic indicators point towards female.

SKELETAL AGE ASSESSMENT

- Based on the reconstructed length of the femur, the individual was around 8 years with an age range of 24 months.
- The only indicator for age in the closures and fusions of the axial was the acetabulum – this had not yet fused. All other indicators were missing or fragmentary. An unfused acetabulum would mean the individual was younger than 17.
- All epiphyses which were present had not yet fused.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Besides the green residue, a small fragment of possible glass was found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1603	3290	skullfrag	green residue	22	11	0,739	0,306	4,36	0,044	0,171	0,458	61	74	0,213
1604	3290	skullfrag	achtergrond meting	28	23	8,44	0,587	3,25	0,016	0,164	0,925	35	59	0,137
1605	3290	GLS		14	6,59	0,354	0,407	119	0,027	18	4,14	-63,350	12	1,39

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1603	116	14415	4388	274	60	128	216	1,84	23	3,06	23	71	102	71	94	79
1604	198	18266	135	523	23	248	148	1,84	24	2,57	19	35	233	35	74	44
1605	236	27627	110	61	20	73	232	219	27	5,69	6655	56	112	56	150	64

3426

OVERVIEW

Number:	3426	/ Crown number:	none
Reference number:	3426-V-M		
Photo ID:	2113-2131		
Level (put/vlak/spoor):	16/7/92		

SUMMARY

Sex development:	MALE
Age-at-death:	49 years ± 2,5yrs / used method: COMPLEX
Calculated stature:	183,02cm ± 3,27cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	no green residue or artefacts
Pathological & remarks:	prominent angle mandible on left side, caries, abscesses and fistulae in maxilla and mandible, periodontitis, healed periostitis on tibiae, marginal osteophytes in shoulder, both ankles, and vertebrae (all indicating possible DISH), VOA in high thoracic vertebrae, DDD+FAO in low thoracic vertebrae, codfish appearance lumbar vertebrae, TMJ OA on right side, enthesopathies ossification: radius tuberosity, cortical defect left clavicle, probably unfused malleolus of the tibia, right MT5 has erosion and no distal end

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humerus, radius, ulna (no distal end), femur, tibia, fibula (no proximal or distal end), 2nd rib, 5 rib shaft fragments with sternal end, 3 rib shaft fragments; *Hand:* trapezium, 1st - 3rd metacarpal; *Foot:* talus, navicular, cuboid, 1st, 2nd, 5th metatarsal, 1st proximal phalange.	Frontal, zygomatics, maxillae, mandible, right parietal and temporal, superior side of left parietal, fragment of left temporal, occipital (missing right side), both clavicles, lateral sides of both scapulae, fragment of superior side corpus sterni, sternum fragments, C1, C5-C7, T1-T3, 4 lower T fragments, L1-L5, sacrum (missing inferior side), left and right ilium (no iliac crest) with partial ischium and acetabulum, left fragment of pubis. Indeterminable: 2 proximal hand phalanges, 4 intermediate hand phalanges, 1 distal hand phalange.	*General:* femur (missing epicondyles), patella, tibia, fibula (no proximal end), 1st and 2nd rib, 3 rib heads, 2 rib heads with shaft, 1 rib shaft fragment, 1 sternal rib end; *Hand:* none; *Foot:* talus, calcaneus, cuboid, lateral cuneiform, medial cuneiform, 1st, 2nd, 4th and 5th metatarsal, 1st proximal phalange.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
P	A	A	A	I	I	I	I		I	I	P	P	I	A	A	I
						c	c			c			c			c
		c		c	c											
A	P	I	P	I	I	P	P		I	I	P	P	P	P	A	A
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38

- Most of the teeth have severe dental wear and are affected by caries (of 46, only the root is still present).
- Abscesses are present at the locations of 11, 12, 13, 14 in the maxilla and at the locations of 33 (possibly), 34, 43-44, 45, 47-48 in the mandible. Fistulae are present at the locations of 34 and 44.

PATHOLOGICAL/REMARKS

- Eburnation is present on the inferior body of the C1. On the superior surface of the C5 and C6 there are marginal osteophytes present, but there is also erosion present on the C6. DDD is present on the C7, and the inferior articular facet also shows on the left side eburnation, correlated with the eburnation of the superior articular facet of the T1. Both the T3 and T4 have on the superior articular facets eburnation. The T7-L1 show both Schmorl's nodes and FAO. In addition to this, the T12 has also marginal osteophytes on its inferior surface and is slightly compressed to the right.L1-L3 have a codfish appearance and there appears to be some fusion between the L5 and the first sacral vertebral body. In conclusion, VOA is present in the high thoracic vertebrae, and DDD and FAO is present in the low thoracic vertebrae. The marginal osteophytes/FAO indicates DISH.
- The distal facet of both tibiae are morphologically different, it is possible that the malleolus has not fused.
- Marginal osteophytes are present in the right shoulder, but POA is not present. This is the same for the left lateral knee joint, both ankles and in the right foot, which also might indicate DISH. However, POA is present in the right hip (marginal osteophytes, erosion, and eburnation). TMJ osteoarthritis is present on the right side.
- Periostitis is present on both tibiae, but this is healed. There is active periostitis on the tarsals.
- There is erosion present on the metatarsal 5, and its distal end seems also to be eroded/shortened. This would be an indication for leprosy, however there are no other elements affected and there is no substantial active periostitis.
- A cortical defect is present on the left clavicle, and the radius tuberosity has some ossification (both enthesopathies).
- The angle on the left side of the mandible is very prominent (new bone formation).

SEX ASSESSMENT

- The sexualization degree of the pelvis is +1.47. In total 89,47% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,75. The skull could be scored on all traits. This was the same for the mandible, though the sexualization degree is +0,5. In total the skull has a sexualization degree of +0,68.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the pubic symphysis and the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase IV and the spongiosa in the proximal end of the humerus and femur were in phase II. The pubic symphysis was in phase III. This gives an age-at-death at 49 years with an age range of 2,5 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase V (age-at-death: 40-44).
- Using the Suchey-Brooks method, the pubic symphysis was also in phase IV (age-at-death: 23-57).

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. The maximum condylar-malleolar length of the tibia was used for the method from Breitinger. For the Trotter & Gleser method the length of the femur was used. With Breitinger, this resulted in a stature of 179,58cm with a standard deviation of 4,70cm. With the method from Trotter & Gleser this was 183,02cm with a standard deviation of 3,27cm.

DESCRIPTION ARTEFACTS

- No green residue or artefacts are present.

XRF MEASUREMENTS

- No XRF measurements were taken.

3515

OVERVIEW

Number:	3515	/ Crown number: none
Reference number:	3515-J-O	
Photo ID:	1736-1749	
Level (put/vlak/spoor):	16/2/17	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	12 – 16 years	/ used method: dental/fusions axial
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue is present on the right orbit-zygomatic and on the left ilium (iliac fossa), some green residue on the left first upper premolar	
Pathological & remarks:	skeletal age is "younger" than dental age, symptoms of rickets in the lower leg (vitamin D deficiency), impacted canines, enamel hypoplasia	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus (no distal end), proximal and distal ulnar shaft, femur (proximal end), patella, tibial shaft, fragments fibula; *Hand:* none; *Foot:* none;	Fragments of both orbits, right zygomatic, both parietals, both temporals, mandible (complete), fragment left clavicle, lateral sides both scapulae, fragments of C1 and C2, T10-T12, 2 T fragments, L4-L5, left ilium, right ilium (fragmentary), left ischium; Indeterminable: fragments long bones, 2 distal hand phalanges, 1 epiphysis of phalange/metacarpal, fragments of foot and hand bones.	*General:* distal end humerus, proximal ulnar shaft, femur (proximal end), tibial shaft, fragment fibula; *Hand:* none; *Foot:* none.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
U	I	I	I	I	I	M	M		M	I	I	I	I	I	I	U
				h							h					
	h	h	h	h								h				
U	I	I	I	I	I	I	I		I	P	I	I	P	P	P	U
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38

- 13 and 23 have not fully erupted and are impacted canines. It overlaps and is misaligned with the incisors.
- The upper premolars are double rooted.
- Calculus is present on the premolars (upper and lower right) and on the lower incisors.
- The upper M3's are unerupted but could be inspected, as they were not in the jaw.
- The lower M3's were still in their sockets and only their crowns could be inspected.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location and multiple lines suggest a metabolic upset between 2 – 5 years.
- There are some symptoms present of rickets in the lower limbs. Both femora and tibiae are slightly bowed.

SEX ASSESSMENT

- Not possible due to age, though some traits score slightly female. The mastoid process is small, the greater sciatic notch is rather wide and the mandible is quite gracile.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed between the phases of 12 years and 15 years.
- The fusions and closures of the axial skeleton do not completely correspond with the above age range. The neuro-central junction was fusing, which suggests an age of 3-6 years.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1597	3515	zygomatic R	green residue	28	28	3,41	0,039	4,85	0,004	0,104	1,96	34	57	0,620
1598	3515	zygomatic R	green residue zygomatic process/frontal	28	26	4,94	0,047	6,57	0,014	0,129	1,75	33	56	0,585
1599	3515	zygomatic R	achtergrond meting	29	25	2,22	0,180	11	0,059	0,247	2,92	30	59	0,390
1600	3515	orbit	green residue	29	25	4,22	0,036	2,46	0,017	0,063	1,08	37	59	0,892
1601	3515	orbit	achtergrond meting	41	36	2,36	0,016	4,14	0,014	0,100	0,679	16	50	0,270
1602	3515	RP1 lower	green residue geen achtergrond meting mogelijk	38	39	0,915	0,050	4,79	0,017	0,099	1,74	15	48	0,249
1606	3515	pelvis	green residue	23	17	1,76	0,022	0,988	-0,002	0,026	0,522	57	70	1,82
1607	3515	pelvis	on iliac crest	30	27	4,09	0,065	14	0,079	0,274	3,28	21	53	0,284
1608	3515	pelvis	achtergrond meting	35	24	2,62	0,420	3,17	0,012	0,111	0,569	34	59	0,351

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1597	276	17155	37400	13248	412	289	87	1,84	22	1,63	132	31	115	31	51	44
1598	290	15987	25383	6688	841	289	138	1,84	22	1,50	239	24	132	24	48	30
1599	96	16078	2488	4150	503	199	134	1,84	24	2,79	113	52	146	52	87	55
1600	215	22121	29552	6833	896	273	129	1,84	22	1,64	273	29	130	29	49	46
1601	251	37011	2650	8056	51	274	120	1,84	22	2,42	17	25	105	25	51	45
1602	2451	22322	22139	15602	322	232	232	1,84	22	1,65	90	30	74	30	60	99
1606	265	13196	18173	4592	2171	179	113	1,84	23	2,14	624	33	109	33	60	42
1607	321	23179	15345	2854	334	219	82	4,16	33	1,50	84	39	123	39	48	36
1608	255	28135	3854	4106	458	227	148	2,15	34	4,02	80	42	139	42	66	47

3797

OVERVIEW

Number:	3793	/ Crown number:	3797
Reference number:	3797-V-O		
Photo ID:	1672-1686		
Level (put/vlak/spoor):	18/1/2		

SUMMARY

Sex development:	INDETERMINABLE (skull indicate probable female)
Age-at-death:	> 21 years / used method: dental
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue is present on indeterminable skull fragments, on the frontal, occipital, parietal and temporal – all on the right side, small artefacts present of pottery and glass
Pathological & remarks:	very fragmented

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: lateral side patella, anterior-proximal surface of tibia; *Hand:* hamate, 1st metacarpal and distal end of 3rd metacarpal, 2nd and 5th proximal phalange, 2nd intermediate phalange; *Foot:* fragment of talus.	Fragments of the frontal and right parietal, left parietal, occipital, left temporal, left zygomatic, left side of mandible, left side of C1, 1 C vertebra, 1 T vertebra, 3 neural arches, not sided fragments of the humerus, femur and fibula, spine of the sacrum.	*General:* distal humeral shaft; *Hand:* lunate; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	M	M	M	M	M	M	M		M	M	M	I	M	M	M	M
M	M	M	M	M	M	M	M		M	M	M	M	M	A	P	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Only 1 tooth present, on which dental wear is present.
- Behind the 37 there is still space for the 38, which appears to be lost ante-mortem. The 36 is also lost ante-mortem.

PATHOLOGICAL/REMARKS

- Not visible.

SEX ASSESSMENT

- Only skull indicators were present and could be scored. The cranium has a sexualization degree of -1,7 and 58,33% could be scored. The mandible could only be scored on 1 trait, which was the angle. In total the mandible has a sexualization degree of -1 and 25% could be scored. In total the skull has a sexualization degree of -0,16 and 50% could be scored.

SKELETAL AGE ASSESSMENT

- Only the dental data was present to give an age indication. The M3 was lost ante-mortem, meaning it had erupted. The age of this individual is adult, placed at 21 years or older. Based on the dental wear on the premolar it is possibly an older adult.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to fragmentation of the bone.

DESCRIPTION ARTEFACTS

- Besides the green residue, small artefacts have been found. This includes glass fragments (very thin and small), 4 small iron objects which resemble nails, 1 other small iron object, 5 larger iron objects (indeterminable), a small piece of pottery and fragments of green residue. There are also small fragments of wood present.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1530	3797	parietal	green-blue residue	31	28	1,56	0,015	4,06	0,015	0,142	1,07	35	58	0,304
1531	3797	parietal	Concentration green-blue residue	38	31	0,906	0,022	10	0,032	0,191	3,47	16	45	0,455
1532	3797	parietal	achtergrond meting	45	34	0,612	0,039	1,67	0,019	0,031	0,805	18	51	0,200
1533	3797	parietal R	green residue	28	22	4,76	0,059	6,24	0,019	0,221	1,67	37	61	0,254
1534	3797	parietal R	achtergrond meting	44	37	1,77	0,101	6,68	0,021	0,109	3,65	6,52	45	0,500
1535	3797	occipital	green residue	27	21	1,70	0,044	8,00	0,043	0,151	2,03	40	60	2,45
1536	3797	occipital	achtergrond meting: mislukt	23	6,06	1,81	0,313	3,11	0,046	0,172	0,351	65	77	0,124
1537	3797	occipital	achtegrond meting	32	23	3,76	0,319	11	0,082	0,289	2,80	26	56	0,308
1538	3797	parietal L	green residue, aansluitend op occipital	22	17	2,80	0,043	3,49	0,011	0,067	0,989	53	66	3,02
1539	3797	parietal L	achtergrond meting	39	32	2,71	0,356	11	0,035	0,193	2,15	13	48	0,224
1540	3797	skullfrag	green residue geen achtergrond meting mogelijk	31	29	2,12	0,043	1,79	0,008	0,053	1,01	35	55	1,18
1541	3797	parietal	green residue geen achtergrond meting mogelijk	32	31	3,70	0,058	1,67	0,012	0,073	1,70	30	54	0,795
1542	3797	frontal?	green residue geen achtergrond meting mogelijk	28	29	4,12	0,071	2,92	0,007	0,062	1,90	35	55	2,14
1543	3797	parietal inferior	green residue geen achtergrond meting mogelijk	33	28	1,89	0,015	16	0,063	0,252	4,02	17	50	0,467
1544	3797	skullfrag	green residue geen achtergrond meting mogelijk	43	31	4,72	0,052	12	0,039	0,220	4,40	4,58	41	0,635
1545	3797	parietal R?	green residue	31	31	3,27	0,108	5,43	0,011	0,108	2,29	27	52	1,92
1546	3797	parietal R?	achtergrond meting	31	26	5,17	0,781	6,94	0,044	0,266	1,45	28	56	0,221
1547	3797	skullfrag	green residue	34	27	1,62	0,015	8,97	0,035	0,167	2,23	25	55	0,298
1548	3797	skullfrag	achtergrond meting	43	37	1,54	0,082	2,93	0,019	0,077	0,920	15	50	0,125
5577	3797	occ inf R	green residue (achtergrond meting al eerder genomen)	23	17	6,04	0,105	7,8	0,007	0,193	0,895	45	65	0,25

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1530	5215	21989	42640	3244	52	146	129	1,84	22	1,64	67	33	82	33	52	35
1531	4543	22061	51050	4888	342	189	131	1,84	22	1,67	94	27	71	27	54	51
1532	313	22501	491	620	12	148	146	1,84	22	1,74	11	27	64	27	57	36
1533	263	17394	14866	5781	103	236	148	1,84	24	2,17	73	37	160	37	67	72
1534	678	30182	514	1559	185	254	145	1,84	22	2,18	80	26	95	26	54	53
1535	1025	16252	22469	6574	5734	234	140	3,24	23	2,13	1555	33	103	33	59	42
1536	51	6626	858	1961	243	210	94	1,84	22	2,01	81	19	97	19	58	40
1537	454	19628	2246	3115	166	242	265	1,84	22	1,64	69	30	134	30	57	86
1538	979	23229	28982	4864	4713	177	187	3,19	24	2,73	1356	40	141	40	76	126
1539	637	25176	5165	5579	83	269	116	1,84	23	2,59	41	33	105	33	51	48
1540	891	17898	40089	7433	1285	170	142	1,84	22	1,50	397	31	89	31	50	58
1541	743	26356	40308	7856	522	249	99	1,84	22	1,78	207	28	124	28	53	50
1542	968	21643	52367	5961	3854	220	136	2,20	22	2,60	1104	29	128	29	54	37
1543	445	22182	29876	5561	198	159	130	1,84	22	1,50	82	25	85	25	49	49
1544	445	35209	20478	5109	191	322	79	1,84	24	3,70	136	25	144	25	53	29
1545	867	28809	34056	7763	2716	250	107	2,78	22	1,64	811	28	115	28	54	48
1546	471	17682	7609	4891	119	247	104	3,34	22	2,64	70	28	146	28	56	54
1547	398	17166	11171	5868	42	167	134	1,84	22	1,57	39	37	86	37	51	36
1548	192	32474	755	1041	23	181	91	1,84	22	1,53	20	31	87	31	54	33
5577	267	17633	12268	4434	146	42	159	1,84	23	215	78	2,05	9,37	34	64	53

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	3.797.008	MXX	koperdraad	60,15	<0,1	0,97	0,35	0,64	0,22	<0,1	<0,1	<0,2	35,74	zilver: veel	goud: nee

3974

OVERVIEW

Number:	3974	/ Crown number:	none
Reference number:	3974-V-VR		
Photo ID:	2179-2195		
Level (put/vlak/spoor):	16/10/177		

SUMMARY

Sex development:	FEMALE
Age-at-death:	40,33 years ± 3yrs / used method: COMPLEX
Calculated stature:	165,5cm ± 4,45cm / used method: Trotter & Gleser (hum)
Artefacts/crown/ residue on bone:	green residue is present on the left temporal and occipital
Pathological & remarks:	enamel hypoplasia, caries, calculus, abscesses in maxilla, POA in hip joints, POA in left lateral knee (osteochronditis dissecans, trauma related?), hyperplasticity left femur and right humerus (vitamin D deficiency), left and right auricular surface assymetric phases, periostitis tibiae, VOA in cervical, low thoracic and lumbar vertebrae, general degenerative processes – possibly an infection (?)

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus (no proximal end), radius (no distal shaft and end) ulna (eroded, no distal shaft and end), femur (missing neck, no distal end), tibia (no proximal end, no distal shaft), 9 rib heads; *Hand:* 2nd, 3rd and 5th metacarpal; *Foot:* none.	Frontal, zygomatics, maxillae (left fragmentary), mandible, both parietals and temporals (between left temporal and parietal there is a fragment missing), occipital (no inferior side), both clavicles (left is eroded), superior edge right capula, medial side left scapula, all vertebrae (T1-T3 no vertebral bodies, for L vertebrae only neural arches), S1 and sacrum fragments, left and right ilium with partial ischium and acetabulum. Indeterminable: tibia and fibula fragments.	*General:* humerus, radius (no distal end), ulna (no distal end), femur (no distal shaft, fragmented distal end), tibia (no proximal end), fibula (no proximal end), 8 rib heads; *Hand:* scaphoid, trapezium; *Foot:* none.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
A	I	A	A	A	P	I	A		I	I	I	A	P	A	A	A
	c					c				c / h	c / h					
				c		c			c	c	c					
C	P	P	P	I	P	I	A		I	I	I	P	P	A	A	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- The only molar present (17) has assymetrical dental attitrion. The occlusal surface on the lingual side has severe dental attrition, whereas the occlusal surface on the buccal side has less dental attrition. The upper left incisors have also assymetrical dental attrition.
- Caries is present on the teeth; these are all interproximal caries. For the 17 this is only present on the mesial side, and for 44, 42 and 33 this is on the distal side. The other elements have interproximal caries on both distal and mesial sides.
- Calculus is present on the buccal surface of the 17.
- An abscess is present at the location of 12 and 25.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests there was a metabolic upset around the age of 2-4 years.
- Marginal osteophytes and erosion/subchondral cysts are present in both the left and right hip joint, indicating POA. In addition to this, the left knee (right one is unobservable) has on the lateral side indications for osteochronditis dissecans, and on the medial side marginal osteophytes. The osteochronditis dissecans might indicate trauma.
- Periostitis is present on the tibiae. This new bone formation is local and sclerotic and is located lateral.
- Especially the pelvic area indicates some pitting and degenerative processes (there is pitting on the ischial tuberosity), which might be related to an infection.
- Both the left femur and right humerus show some hyperplasticity, indicating possibly a vitamin D deficiency.
- The articular facets between the C2 and C3 have (on the left side) marginal osteophytes and eburnation. This is also present between the C7 and T1. Marginal osteohytes on the right articular facets are also present between the L2-L5. The inferior facet of the L2 shows severe change of contour. The inferior facets of the L5 shows marginal osteophytes and erosion, which is also present on the first sacral vertebral body, and indicates possibly an infection. On the S1 there is reactive new bone formation. For the vertebral bodies, there are marginal osteophytes and erosion present between the C4-C7, on the inferior surface of the T9, T10, L1, and on both superior as well as inferior surfaces of the T12. The marginal osteophytes of the T12 are DISH related, not DDD related. Schmorl's nodes are present on the inferior surface of the T3, T8 and T12. In conclusion, there is VOA present in the cervical, low thoracic, and lumbar vertebrae.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -0,9. In total 57,89 of the pelvis could be scored.
- The sexualization degree of the cranium is +0,09 and in total 87,5% could be scored. The sexualization degree of the mandible is -0,25 and could be scored on all traits. In total the skull has a sexualization degree of 0 and could be scored for 90,62%

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase III. Both the spongiosa in the proximal end of the humerus and femur were in phase II. This gives an age-at-death at 40,33 years with an age range of 3 years.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface was assymetrical. For the left side, the morphology was in phase VII (age-at-death: 50-59), and for the right side this was phase V (age-at-death: 40-44).

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser was used, using the measurement of the humerus. This resultated in a stature of 165,5cm with a standard deviation of 4,45cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4656	3974	temp-occ L	green residue	30	25	2,68	0,228	3,5	0,022	0,096	1,14	37	60	0,675
4657	3974	parietal R	achtergrond meting	36	29	1,92	0,303	11	0,067	0,243	3,24	18	53	0,08

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4656	196	19108	15894	7508	378	48	181	1,84	22	320	125	1,5	6,64	53	49	73
4657	240	23531	16	393	95	44	121	2,06	23	341	24	1,8	4,71	35	52	45

4139

OVERVIEW

Number:	4139	/ Crown number:	4139
Reference number:	4139-V-M		
Photo ID:	2196-2212		
Level (put/vlak/spoor):	16/14/256		

SUMMARY

Sex development:	MALE
Age-at-death:	50-65 years / used method: COMPLEX
Calculated stature:	178,86cm ± 4,05cm / used method: Trotter & Gleser (hum)
Artefacts/crown/ residue on bone:	green-blue residue on the inside of the right zygomatic, blue residue on humerus
Pathological & remarks:	only skull present with some post-cranial fragments present, caries, abscesses in maxilla and mandible, crowding of anterior teeth in mandible, new bone formation on condyles > seronegative spondyloarthropathy?, VOA in cervical vertebrae, fusion of articular facets between C2-C3; C5-C6

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus, 1st rib; *Hand:* none; *Foot:* none.	Skull is complete except for a hole in the frontal (right-lateral) and some small missing fragments (small holes in zygomatic, occipital, right temporo-zygomatic process not present), both clavicles (no medial or lateral end), lateral side left scapula, fragment of hyoid (fused), ossified cartilage (?), C1-C7 and T1.	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
A	P	I	I	I	I	I	I		P	P	I	I	I	A	I	A
		6-		c	c										4-	
A	P	A	I	I	I	I	I		I	I	I	I	P	P	A	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe dental wear present on most of the teeth.
- Caries is present on 13 (distally) and 14 (buccally).
- Abscesses are present at the location of 22, 35, and 36.
- Crowding of the teeth is present in 31, 32, 41, and 42.

PATHOLOGICAL/REMARKS

- There is bone formation along the greater foramen of the atlas, at the side of the condyles, which might indicate a seronegative spondyloarthropathy. The inferior articular facet of the atlas and the superior articular facet of the axis have both marginal osteophytes (dens axis), the superior articular facet of the axis also has eburnation. The C2 and C3 have fused together with their articular facets and neural arches (on the sides, mostly left side), but the intervertebral discs have not fused. On the inferior surface of the C3, both surfaces of the C4, and the superior surface of the C5, marginal osteophytes and eburnation are present (severe on the inferior surface of the C4). Furthermore, on the inferior articular facets of the C3 and the superior articular facet of the C4 erosion is present on the right side, indicating VOA. The articular facets between the C5 and C6 have also fused together, similar to the C2 and C3. Marginal osteophytes are present on the inferior surface of the C6 and superior surface of the C7.

SEX ASSESSMENT

- The sexualization degree of the cranium is +0,58. The skull could be scored on all traits. This was the same for the mandible, though the sexualization degree is +1. In total the skull has a sexualization degree of +0,68.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the humerus. The endocranial suture obliteration was in phase IV. The spongiosa in the proximal end of the humerus was in phase III. This gives an age-at-death between 50-65 years.

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. For both methods only the measurements of the humerus could be used. With Breitinger, this resulted in a stature of 177,14cm with a standard deviation of 4,9cm. With the method from Trotter & Gleser this was 178,86cm with a standard deviation of 4,05cm.

DESCRIPTION ARTEFACTS

- Except for the green and blue residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2416	4139	zygomatic R	blue-green residue inside zygomatic	16	11	5,62	0,284	5,95	0,054	0,270	0,440	60	73	0,630
2417	4139	zygomatic R	achtergrond meting	20	14	2,80	0,602	10	0,084	0,218	0,761	51	71	0,044
2418	4139	zygo-temp proc R	(past aan zygo R) green residue	24	19	5,87	0,357	14	0,107	0,359	3,58	33	57	0,378
2419	4139	zygo-temp proc R	(past aan zygo R) achtergrond meting	39	30	2,01	0,782	7,75	0,059	0,175	2,37	18	51	0,623
4678	4139	hu R	blue residue	31	29	6,52	0,869	4,01	0,029	0,13	0,944	27	56	0,38

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2416	1347	13626	29772	126	59	297	265	1,84	22	1,50	28	70	117	70	44	61
2417	151	18581	247	240	189	275	428	15	85	1,96	23	116	118	116	69	100
2418	541	16879	39858	373	181	430	126	1,84	21	1,50	60	38	90	38	32	47
2419	422	34412	4037	627	111	389	139	1,84	24	1,50	33	40	68	40	38	59
4678	381	21970	54	1904	120	70	177	1,84	23	367	38	1,5	5,02	41	57	54

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	4.139.003	MXX	koperdraad	87,69	0,12	0,40	<0,1	2,44	0,31	0,13	0,17	<0,1	7,85	zilver: ja	goud: nee

4453

OVERVIEW

Number:	4453	/ Crown number:	5355
Reference number:	4453-V-VR		
Photo ID:	2238-2248		
Level (put/vlak/spoor):	44/1/2		

SUMMARY

Sex development:	FEMALE
Age-at-death:	40-80 years / used method: COMPLEX
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green on occipital, green residue with organic material on right temporal, blue residue on skull (locally) and sutures, blue residue on scapula
Pathological & remarks:	only skull present with some post-cranial fragments, button osteoma, no pathological remarks visible

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: none; *Hand:* none; *Foot:* none.	Fragments of frontal, right orbit and mandible, right parietal, fragment of left parietal, occipital (only superior side), right temporal, lateral border right scapula	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

– No dental data: from what could be inspected of the mandible was very eroded.

PATHOLOGICAL/REMARKS

– On one of the frontal fragments a button osteoma is present.

SEX ASSESSMENT

- The sexualization degree of the cranium is 0. The skull could be scored for 41,66%. The sexualization degree of the mandible is -0,35 and could be scored for 37,5%. In total the skull has a sexualization degree of -0,07 and could be scored for 40,62% .

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration. The endocranial suture obliteration was in phase IV. This gives an age-at-death between 40 and 80 years.

ESTIMATION OF ANTE MORTEM STATURE

- This could not be done due to absence of the long bones.

DESCRIPTION ARTEFACTS

- Except for the green and blue residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4628	4453	occipital R	green residue	25	13	4,19	0,217	2,95	0,031	0,153	0,472	54	68	0,967
4629	4453	occiptial R	green residue extra meting	24	16	3,8	0,191	7,23	0,019	0,145	1,84	47	64	1,06
4631	4453	occiptial L	green residue	25	17	4,97	0,201	1,8	0,028	0,052	0,587	50	66	1,04
4632	4453	occipital	achtergrondmeting (half)	32	-0,07	2,99	0,285	0	0,088	0,316	0	64	74	0
4633	4453	occipital	achtergrondmeting	30	24	3,97	0,26	13	0,066	0,292	2,53	25	56	0,412
4634	4453	frag frontal	blue residue	31	21	3,72	0,209	9,01	0,066	0,186	1,18	34	60	0,462
4635	4453	temporal R	green residue	17	6,38	2,25	0,154	15	0,118	0,367	1,58	57	67	5,39
4636	4453	temporal R	achtergrond meting	12	7,24	3,01	0,098	16	0,151	0,48	1,3	60	77	0,175

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4628	454	14591	18230	3617	523	45	129	1,84	22	265	166	1,5	6,85	33	51	43
4629	415	16013	33235	3387	591	52	208	1,84	22	256	187	1,51	9,18	39	54	64
4631	264	28846	18103	5734	2322	73	214	1,84	23	216	581	1,92	15	52	58	93
4632	0	0	1197	598	794	430	1257	1,84	22	186	207	2,3	7,94	376	51	428
4633	326	19384	2070	641	816	52	183	1,84	23	192	224	1,5	7,91	38	52	51
4634	282	19519	831	581	791	59	238	2,85	22	200	201	1,62	8,89	46	62	122
4635	352	12795	24900	3826	1126	48	177	6,62	42	190	533	1,5	19	38	53	50
4636	192	18219	1068	240	1116	85	340	14	61	131	176	3,79	17	69	117	183

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	5.355.001	MXX	koperdraad	90,93	<0,0	1,05	3,14	0,40	<0,0	<0,0	<0,0	0,18	3,92	zilver: veel	goud: ja

4883

OVERVIEW

Number:	4883	/ Crown number:	none
Reference number:	4883-V-M		
Photo ID:	2132-2163		
Level (put/vlak/spoor):	36/1/3		

SUMMARY

Sex development:	MALE
Age-at-death:	41,5 years ± 2,5yrs / used method: COMPLEX
Calculated stature:	175,17cm ± 3,27cm / used method: Trotter & Gleser (femur)
Artefacts/crown/ residue on bone:	green residue on occipital, lateral end of left clavicle, right scapula, on a sternal rib end (right), on the right femoral shaft, and on right pubic symphysis (posterior)
Pathological & remarks:	DISH and DISH related ossifications, shovel-shaped incisors, caries, abscess and fistula in maxilla, calculus, bone formation in maxilla (infection?), POA clavicle-scapula joints, POA hip joints, marginal osteophytes left shoulder, marginal osteophytes knee joints, rib fracture, VOA, FAO, DDD in cervical vertebrae, FAO in thoracic vertebrae, FAO, DDD in lumbar vertebrae, compression L1-L2, foramen sternale, foramen Huschke

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus (no neck), radius, ulna, femur (missing fragments of proximal and distal shaft), patella, proximal end tibia, all ribs; *Hand:* 1st - 4th metacarpal, 1st and 3rd proximal phalange; *Foot:* talus, calcaneus, fragment of cuboid, 2nd - 5th metatarsal.	Skull is complete, except for some small missing fragments of the nasal bones, both clavicles, both scapulae (no medial borders), sternum is complete, all vertebrae, S1 and sacrum fragments, pelvis is nearly complete except for the left pubis and anterior side of the ilium. Indeterminable: 1 proximal hand phalange, 1 intermediate hand phalange.	*General:* all long bones – though distal and proximal ends are missing, all ribs; *Hand:* hamate, triquetral, lunate, all metacarpals and phalanges; *Foot:* 3rd - 5th metatarsal.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
A	P	A	I	I	P	P	P		P	I	I	I	I	I	P	A
												c		3 / c		
P	P	P	I	I	I	I	I		P	P	P	P	A	A	A	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe dental wear is present. Most of the incisors and premolars have dental wear on their occlusal surfaces. Of the 14 and 15, both distal as mesial surfaces are not present.
- Calculus is present on the 23, 24, 25 and 26, but also on the 42, 43, 44 and 45. It is only present on the buccal side.
- Of the 41, only a partial root is present.
- There is a caries present on the distal surface of 26, and on the occlusal surface of the 24.
- 22 is shovel-shaped.
- An abscess is present at the locations of 17 and 24, both at the labial side. At 17, there is also a fistula present.
- There is new bone formation in the maxilla, which is porous. It is possible this might be related to an infection.

PATHOLOGICAL/REMARKS

- Marginal osteophytes are present in the left and right knee joint (lateral as well as medial), but POA is not present. This is the same for the left shoulder. However, POA is present in both clavicula-scapula joints, as there is change of contour and erosion present. There is severe POA in both hip joins, as there are sever marginal osteophytes, erosion, and eburnation present on both the acetabulum as well as the femoral head.
- There is a rib fracture (healed, on the shaft) present on one of the right ribs. It is possible there is another right rib fracture, as there is some new bone formation on the vertebral end of another (indeterminable) right rib.
- There is overall ossification, which is related to DISH (ossification of the sternum/cartilage).
- On the inferior articular facet of the C2, on both of the articular facets of the C3-C5, and the superior articular facet of the C5, there are VOA present. This is indicated by erosion, both left and right interchangeably and for some facets there is also change of contour or marginal osteophytes present. On the body of the C4-T1 there are marginal osteophytes present, and on the C4 as well as the C7 this is also present with FAO. On the higher as well as the lower thoracic vertebrae there is FAO present. On the inferior surface of the T8 there is a Schmorl's node present. FAO and DDD is also present in the lumbar region, this is indicated by marginal osteophytes and eburnation between the articular facets. In addition to this, the L1 and L2 are compressed anterior-posteriorly, of which the anterior compression is more downwards than the posterior compression. Related to this, there is also new bone formation.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +1. In total 84,21% of the pelvis could be scored.
- The sexualization degree of the cranium is +0,58. The skull could be scored on all traits. This was the same for the mandible, though the sexualization degree is +0,875. In total the skull has a sexualization degree of +0,65.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration, the spongiosa in the proximal femur and humerus, as well as the pubic symphysis. The spongiosa in the proximal femur and humerus was observed and scored based on the development of the medullary cavity. Both were in phase II. The endocranial suture obliteration was in phase IV and the pubic symphysis was in phase III. This gives an age-at-death at 41,5 years with an age range of 2,5 years.
- Using the Suchey-Brooks method, the pubic symphysis was in phase II (age-at-death between 19-34)

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. The length of the humerus was used for the method from Breitinger, and the length of the femur for the method from Trotter & Gleser. With Breitinger, this resulted in a stature of 169,5cm with a standard deviation of 4,9cm. With the method from Trotter & Gleser this was 175,17cm with a standard deviation of 3,27cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4637	4883	clavicle L	green residue	5,78	0,76	0,45	0,022	5,17	4,09	0,072	0,453	83	90	0,055
4638	4883	clavicle L	extra meting green residue	32	24	0,78	0,495	13	0,089	0,217	2,64	27	56	0,513
4639	4883	clavicle L	achtergrond meting	32	27	0,325	0,274	8,39	0,033	0,142	2,96	29	58	0,964
4640	4883	pubis R	green residue	26	18	1,38	0,048	32	0,219	0,616	6,05	14	49	0,587
4641	4883	pubis R	achtergrond meting	32	21	1,28	0,282	21	0,167	0,36	3,47	20	54	0,42
4642	4883	scapula R	green residue	31	26	0,77	0,08	32	0,203	0,579	6,01	3,57	45	0,95
4643	4883	scapula R	achtergrond meting	18	13	1,84	0,283	52	0,339	0,919	6,27	7,38	51	0,418
4644	4883	sternal rib end R	green residue	24	15	0,925	0,183	29	0,186	0,49	5,06	25	58	0,414
4645	4883	sternal rib end R	extra meting green residue	17	11	0,655	0,09	19	0,145	0,384	3,1	49	70	0,337
4646	4883	sternal rib end R	achtergrond meting	18	13	0,896	0,37	29	1,13	0,486	3,96	33	63	0,381
4649	4883	sphenoid L	green residue	40	24	1,48	0,084	30	0,345	0,693	5,26	-1,025	40	0,794
4650	4883	maxilla L	green residue (above 2.2)	31	17	0,935	0,142	31	0,177	0,444	5,09	14	50	0,541
4652	4883	occipital C	green residue	30	22	0,893	0,394	4,89	0,033	0,092	1,52	40	61	1,37
4653	4883	occipital R-parietal R	green residue	30	20	0,606	0,594	15	0,068	0,215	3,21	31	58	0,815
4654	4883	parietal R	green-black residue	32	22	0,676	0,197	13	0,066	0,208	3,76	27	55	0,643
4655	4883	parietal L	achtergrond meting (ook voor 4649 tm 4654)	38	27	0,634	0,25	19	0,13	0,272	5,7	9,2	47	1,02
4669	4883	femur R	green residue	37	29	0,487	0,297	6,96	0,036	0,074	2,14	25	54	0,497
4672	4883	femur R	achtergrond meting	37	30	0,688	0,538	7	0,037	0,106	2,92	21	53	0,758

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4637	57	7106	2302	828	287	39	111	1,84	21	47	51	1,5	4,46	33	42	53
4638	249	28166	11088	3845	1206	42	159	1,84	22	283	255	1,5	9,1	34	45	52
4639	337	20818	689	802	1085	53	305	1,84	22	190	311	1,5	9,21	41	57	134
4640	298	17625	28388	5980	1055	55	157	8,84	57	264	194	1,5	9,46	37	48	50
4641	181	28189	215	925	680	51	184	6,35	43	185	114	1,5	7,12	37	48	48
4642	244	44791	15207	1799	875	92	353	5,12	49	195	147	2,57	12	72	79	134
4643	77	12418	320	850	828	42	186	8,89	105	201	147	1,5	7,31	41	46	44
4644	153	13045	4081	2156	759	41	115	2,83	32	156	147	1,5	6,9	34	44	52
4645	73	9483	7191	2228	706	57	156	1,94	22	146	91	1,5	7,98	45	55	59
4646	131	17366	584	961	811	49	117	2,06	23	121	154	1,5	6,97	39	43	43
4649	364	51251	15964	1362	1620	173	421	5	29	245	290	8,37	27	167	167	253
4650	359	18780	11374	4101	790	47	130	3,55	25	236	157	2,09	7,66	37	48	48
4652	629	24160	15132	4335	1244	44	171	1,84	22	228	325	1,5	9,46	42	49	57
4653	430	30602	15693	4929	908	52	128	1,84	22	235	235	1,5	8,53	41	49	73
4654	517	20681	5606	2595	716	51	151	1,84	22	184	219	1,5	7,6	43	48	42
4655	542	24230	284	532	938	45	208	1,84	22	199	286	1,5	7,86	37	49	71
4669	314	23818	17695	922	447	42	116	1,84	22	246	116	2,28	6,11	33	45	49
4672	313	34491	209	979	697	47	235	2,01	22	236	178	1,5	7,34	37	50	69

4889

OVERVIEW

Number:	4889	/ Crown number:	none
Reference number:	4889-V-M		
Photo ID:	2164-2178		
Level (put/vlak/spoor):	36/1/5		

SUMMARY

Sex development:	MALE
Age-at-death:	41-58 years / used method: COMPLEX
Calculated stature:	171,47cm ±4,05cm/ used method: Trotter & Gleser (hum)
Artefacts/crown/ residue on bone:	green residue is present on the left parietal, right humerus and scapula, glass fragment
Pathological & remarks:	caries, abscess in mandible, maxillary sinusitis, POA in clavicle-scapula, shoulder, left elbow, cribra orbitalia, slightl hyperostosis frontalis interna, ribfracture, cortical defect, DISH, DDD in cervical and low thoracic vertebrae, VOA in cervical and high thoracic vertebrae, FAO present in low thoracic vertebrae

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humerus, radius (no distal shaft or end), ulna (no distal shaft or end), proximal end femur, fragment distal-lateral end tibia, 1st rib, 6 rib heads, 4 rib shaft fragments; *Hand:* lunate, hamate, 1st - 4th metacarpal, 1st - 3rd proximal phalanges, 2nd - 4th intermediate phalanges; *Foot:* none.	Frontal, zygomatics, fragmented maxillae, mandible, both parietals, both temporals, occipital (no inferior side), both clavicles (left only shaft), both scapulae (lateral borders with fragmentary scapular fossa, fragments of the sternum, C1-C6, T and L vertebrae very fragmented, S1, right ilium with partial ischium and acetabulum, left fragment of ilium and ischium.	*General:* humerus, proximal and distal end radius, ulna (missing distal shaft), 1st rib, 6 rib heads, 2 rib shaft fragments; *Hand:* capitate, hamate, trapezium, scaphoid, triquetral, pisiform, all metacarpals, 1st - 4th proximal phalanges; *Foot:* none.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
M	P	M	M	A	A	A	A		A	A	A	A	P	A	A	A
c / 6-			c	c												
I	A	P	I	I	P	P	P		I	P	P	P	A	A	A	A
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe dental wear is present. Because of this, hypoplasia and other remarks were not visible.
- Abscesses are present at the locations of 41 and 42.
- Caries is present on 48, 45 and 44. On 48 this is on the occlusal-mesial surface, on 45 and 44 this is on the distal surface.

PATHOLOGICAL/REMARKS

- There are marginal osteophytes present in the shoulder joints (scapula-humerus), which is more prominent in the right joint than in the left, but for both joints POA is present. POA is also present in the left elbow, as eburnation is present. Furthermore, marginal osteophytes are present in the right hip joint, but POA is not present.
- Hyperostosis frontalis interna is slightly present.
- A rib fracture is present on one of the right ribs (too fragmented to determine). The fracture is located posteriorly, close to the rib head.
- Cortical defects are present on both humerii.
- Maxillary sinusitis is present on both sides, the new bone formation is local, diffuse and sclerotic.
- Cribra orbitalia is present on the left side.
- Some ossifications are present in the tendons/muscle attachments, which indicates DISH. Ossification of the tendons of the iliac crest, arms (distal humerus), hands, and legs are present. The ossification of the muscle attachments in the elbow indicate activity. The trachea is also ossified.
- The atlas shows no pathological remarks, but is morphologically different.
- Marginal osteophytes and erosion are present on the inferior surface of the C2 and superior surface of the C3, as well both surfaces of the C4, the superior surface of the C5, and the inferior surface of the C7. Eburnation is, besides marginal osteophytes and erosion, also present on the inferior surface of the C3. This indicates that DDD is present in the cervical vertebrae. The inferior articular facets of the C5 show erosion, marginal osteophytes and have a sever change of contour. This is also present in the superior and inferior articular facets of the C6, and the superior surface of the C7. Eburnation is also present on the inferior articular facets of the C6 and superior articular facets of the C7. On the inferior articular facets of the C7 and the superior articular facets of the T1, eburnation is present, but only on the left side. The thoracic vertebrae are very fragmented; marginal osteophytes are present on the high thoracic vertebrae but DDD is not present. However, at least two vertebrae show indications of VOA, on the right side. In the low thoracic vertebrae marginal osteophytes are present, as well as anterior ossification of the

ligaments. The marginal osteophytes are more severe than in the high thoracic vertebrae, and indicate DDD. FAO and loss of intervertebral disc height is also present. The lumbar vertebrae only show some slight marginal osteophytes.
- The first rib shows extensive bone formation on its sternal end.

SEX ASSESSMENT

- The sexualization degree of the pelvis is +1,25. In total 42,1% of the pelvis could be scored.
- The sexualization degree of the cranium is +1,35. The skull could be scored for 83,33%. The mandible has a sexualization degree of +0,25 and could be scored on all traits. In total, the skull has a sexualization degree of +1,03 and could be scored for 87,5%.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal humerus and proximal femur. The endocranial suture obliteration was in phase V and the spongiosa in the proximal humerus was in phase II. The spongiosa in the proximal femur was between phase II and III, so an age-at-death was established using both phases. This gives an age-at-death between 41 and 58 (44,67 ±3 years and 55,33 ±3 years).
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase VII (age-at-death: 50-59).

ESTIMATION OF ANTE MORTEM STATURE

- Both the method from Breitinger as well as Trotter & Gleser could be used. Only the length of the humerus could be used in both methods. With Breitinger, this resulted in a stature of 170,63cm with a standard deviation of 4,9cm. With the method from Trotter & Gleser this was 171,47cm with a standard deviation of 4,05cm.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4667	4889	parietal L	green residue	31	23	0,566	0,06	9,45	0,028	0,131	2,52	34	58	1,01
4668	4889	occipital	achtergrond meting	35	32	2,22	0,423	12	0,05	0,227	2,38	16	51	0,365
5539	4889	hu R prox ant head	green residue	34	27	1,88	0,209	22	0,122	0,342	4,97	9,93	47	0,951
5540	4889	hu R shaft ant	achtergrond meting	36	21	1,2	0,145	2,12	0,009	0,054	1,26	39	62	0,461
5550	4889	rib shaft indet	green residue	35	30	2,65	0,096	5,99	0,035	0,14	2,1	23	53	0,628
5552	4889	rib shaft indet	achtergrond meting	40	28	1,57	0,197	5,52	0,056	0,082	1,42	23	53	0,753
5575	4889	scapula R	green residue	22	12	2,54	0,078	19	0,102	0,258	1,59	42	66	0,327
5576	4889	scapula R	achtergrond meting	20	18	5,64	0,213	35	0,103	0,469	2,37	18	55	0,097

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4667	1507	19951	31198	513	1452	64	124	1,84	22	218	405	1,5	10	36	49	65
4668	278	29253	264	707	699	70	151	3,31	22	255	174	1,5	7,7	37	51	69
5539	545	15023	6842	940	1872	29	106	6,91	100	245	331	2,24	11	30	45	40
5540	347	14633	286	952	875	30	132	1,84	22	230	227	1,5	8,03	28	51	31
5550	265	27400	10131	4461	733	33	81	1,84	22	272	209	2,28	8,02	26	49	29
5552	328	26753	417	840	1054	33	90	1,84	23	294	271	3,86	11	27	56	32
5575	103	18872	5655	1273	826	65	148	2,18	25	213	201	4,49	13	70	96	56
5576	259	28755	835	1143	861	136	239	5,27	32	217	143	7,8	26	120	240	104

4891

OVERVIEW

Number:	4891	/ Crown number:	none
Reference number:	4891-V-O		
Photo ID:	no photos taken		
Level (put/vlak/spoor):	36/1/7		

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	indeterminable / adult	/ used method: -
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue on mandible fragment	
Pathological & remarks:	very fragmented individual, no pathological remarks are visible	

SKELETON STATUS

Present:

Right	General/Skull	Left
General: none; *Hand:* none; *Foot:* none.	Only fragments of the skull, mandible, 3 indeterminable teeth (1 molar crown, 2 indeterminable), fragments of the arm (probably ulna), hand, scapula, vertebrae, ribs, femoral shaft, indeterminable fragments.	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38

– No dental data present.

PATHOLOGICAL/REMARKS

– No pathological remarks were visible or observable.

SEX ASSESSMENT

– This could not be assessed due to fragmentation, though possibly female.

SKELETAL AGE ASSESSMENT

- This could not be assessed due to fragmentation, though the fused humeral head indicate an individual of at least 18 years or older.

ESTIMATION OF ANTE MORTEM STATURE

- This could not be assessed due to fragmentation.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2420	4891	mandible frag	green residue	38	33	5,67	0,242	2,73	0,046	0,076	0,878	20	49	0,203
2421	4891	mandible frag	achtergrond meting / wel nog met Cu!	29	24	4,53	1,91	11	0,075	0,253	3,77	25	48	1,38

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2420	159	41554	35992	3260	537	549	912	1,84	22	1,75	39	43	105	43	36	53
2421	199	25642	25714	2411	13058	395	857	12	23	2,72	2449	61	318	61	48	66

5830

OVERVIEW

Number:	5830	/ Crown number:	none
Reference number:	5830-J-O		
Photo ID:	1920-1961		
Level (put/vlak/spoor): 54/2/17			

SUMMARY

Sex development:	INDETERMINABLE / possibly female
Age-at-death:	13,5 – 16,5 years / used method: dental/fusions
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue is present on the occipital-right parietal, on the proximal end of the right radius, proximal end of left ulna, 2 left rib fragments, the posterior aspect of the right ilium, left scaphoid. There is organic residue on the distal left humerus (anterior) and also on the posterior aspect of the right ilium. Artefacts include small fragments of glass (glass splinters) and copper fragments
Pathological & remarks:	sex determination is indifferent

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: trochlea of humerus, proximal end radius and radial shaft, femoral head and proximal femoral shaft, tibial shaft, 1 rib head, 1 sternal rib end; *Hand:* lunate, scaphoid, 1st metacarpal, 1 proximal phalange; *Foot:* none.	Right zygomatic, fragment right temporal, occipital-right parietal (fragmentary), left petrous pyramid, fragment of orbit/sphenoid, fragments of frontal/parietal, scapula fragments, C2 (dens), 5 vertebral bodies, 3 L arches, 5 T arches, 3 C fragments, right ilium and right ischium/acetabulum (fragmentary), left ilium with fragments of ischium/acetabulum. Indeterminable: fragments of radial and ulnar shaft, fibular shaft, unfused proximal tibia, distal and proximal femur fragments.	*General:* humerus (no proximal end), proximal end and shaft ulna, proximal end and shaft femur, tibial shaft, 2 rib heads, 2 rib shafts and sternal rib end; *Hand:* lunate, scaphoid, trapezoid, capitate, hamate; *Foot:* none.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
I	I	M	I	I	M	I	I		I	I	M	M	I	M	I	I
$R^{1/4}$	A^{c}					h	h		h	h					A^{c}	$R^{1/4}$
			h		h	h	h		h	h				h	A^{c}	$R^{1/4}$
M	M	M	I	M	I	I	I		I	I	M	M	I	I	I	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Most of the incisors and premolars present have eroded roots. The roots for the molars were not fully developed.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia on the incisors suggests there was a metabolic upset around 1-2 years; other locations of hypoplasia on the incisors as well as the canine suggest this also happened around 3-4 years. The location of the hypoplasia on the first molar suggest a metabolic upset also around the age of 10-11 years. In addition, on some incisors are multiple lines visible which suggests it also happened around birth.

SEX ASSESSMENT

- Not possible due to age. Pelvis traits score male as well as female.

SKELETAL AGE ASSESSMENT

- Age-at-death of the individual based on dental eruption and mineralization was placed between 15 years (with an age range of 36 months.
- To narrow down the age range, the proximal end of the radius and 1st metacarpal were used. Both were fusing, and not taken sex into account it would mean an age range of 11,5 – 17 years (proximal radius) and 13,5 – 16,5 years (proximal 1st metacarpal).

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Besides the green residue, organic residue has been found on the bone – specifically on the anterior aspect of the distal radius and on the posterior aspect of the right illium. Also, small glass fragments (splinters, very thin) and copper residue has been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1685	5830	pelvis frag	green residue geen achtergrond meting mogelijk	39	26	2,53	0,043	20	0,124	0,402	6,75	5,27	42	0,720
1686	5830	pelvis frag	green residue geen achtergrond meting mogelijk	52	40	1,75	0,067	8,03	0,028	0,159	4,38	-5,781	33	0,759
1690	5830	occipital	green residue	28	23	1,79	0,031	8,87	0,040	0,181	2,84	35	59	0,799
1691	5830	parietal R	green residue	29	22	1,28	0,054	19	0,102	0,304	5,66	24	52	1,10
1692	5830	occipital	achtergrond meting (ook voor 1691)	29	19	3,44	0,063	13	0,129	0,320	2,38	33	59	0,545
2257	5830	ringetje	door H. Huisman gemeten	7,48	20	8,78	0,042	27	0,239	1,03	12	23	20	2,63
3604	5830	tibia	achtergrondmeting	44	35	0,494	0,209	3,15	0,048	0,068	3,28	14	48	1,11
3605	5830	tibia	zwarte residue	38	28	1,06	4,95	13	0,091	0,312	5,14	9,40	45	0,956
5541	5830	hu dist ant	oxx met green residue	10	7,56	4,5	0,403	33	0,325	1,19	5,48	38	63	0,553
5542	5830	hu shaft ant	achtergrond meting	39	30	1,49	0,424	12	0,108	0,244	2,86	14	50	0,403
5561	5830	zygomatic R	green residue (geen achtergrond meting mogelijk)	31	26	4,11	0,215	19	0,187	0,455	6	12	48	0,559
5562	5830	ulna L	green residue	32	20	2,72	0,289	11	0,064	0,179	2,04	32	59	0,392
5563	5830	ulna L	achtergrond meting	27	15	2,31	0,148	17	0,112	0,35	2,03	36	62	0,311
5564	5830	radius R	green residue	29	20	1,4	0,091	7,34	0,033	0,101	1,73	40	60	1,04
5565	5830	radius R	achtergrond meting	35	27	4,3	0,291	9,98	0,039	0,194	3,17	20	52	0,55
5566	5830	scaphoid L	green residue (geen achtergrond meting mogelijk)	25	21	3,81	0,037	19	0,205	0,522	5,02	26	54	0,68
5567	5830	L rib 1	green residue (geen achtergrond meting mogelijk)	41	28	1,92	0,152	17	0,14	0,353	5,44	6,15	41	0,419
5568	5830	L rib 2	green residue (geen achtergrond meting mogelijk)	39	29	2,59	0,094	8,4	0,034	0,123	2,44	19	48	0,478
5569	5830	L rib 3	green residue	28	21	4,13	0,274	19	0,169	0,432	4,01	22	52	0,819
5570	5830	L rib 3	achtergrondmeting	40	33	2,03	0,397	15	0,105	0,228	3,49	5,52	44	0,382
5571	5830	ischium/ ilium R post	green residue and oxx; center	8,49	13	2,68	0,025	15	0,146	0,531	2,43	58	60	0,261
5572	5830	ischium/ ilium R post	green residue and oxx; superior	14	16	2,96	0,029	15	0,187	0,555	2,71	48	58	0,31
5573	5830	ischium/ ilium R post	green residue and oxx; inferior	33	22	1,81	0,039	14	0,067	0,245	3,49	26	52	0,495
5574	5830	ischium/ ilium R post	achtergrond meting	28	18	2,92	0,593	33	0,281	0,746	6,42	10	48	0,536

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1685	435	20309	23845	6568	528	343	90	5,22	23	5,51	146	25	107	25	53	28
1686	215	31276	8960	5693	682	374	104	5,27	24	9,96	170	39	115	39	71	35
1690	134	22380	29859	6011	559	193	137	1,84	22	1,70	191	38	89	38	52	32
1691	190	15128	26779	6234	851	220	81	1,84	22	1,50	248	25	70	25	45	32
1692	99	19653	4855	2310	1548	276	106	7,27	23	2,56	364	23	125	23	53	29
2256																
2257	6334	22204	401426	12866	23284	481	438	42	42	13	3468	104	300	104	258	501
3604	236	18399	505	589	1534	283	143	3,51	21	1,84	460	50	44	50	41	85
3605	199	20547	319	560	1667	335	130	3,09	22	2,39	514	40	62	40	42	49
5541	162	7410	27140	2982	1612	45	128	40	73	168	142	3,36	12	38	49	34
5542	136	18280	438	1193	572	41	136	2,83	26	306	181	4,26	15	37	98	48
5561	122	15693	11003	6494	544	35	110	5,87	23	325	162	2,87	8,79	34	50	29
5562	76	15306	8624	2965	644	40	141	1,84	23	250	182	3,01	9,87	51	65	41
5563	84	12623	2159	1450	506	45	204	3,43	23	211	130	2,56	9,82	36	75	69
5564	200	18751	38878	6366	346	40	96	1,84	22	229	104	1,54	6,35	24	47	41
5565	191	18506	3820	4344	565	31	94	1,84	22	324	156	3,69	7,41	23	49	29
5566	245	13080	36566	6010	1414	39	101	21	43	241	204	2,56	11	34	49	29
5567	183	18707	26120	4623	425	39	75	4,69	24	268	102	4,31	7,24	37	48	27
5568	181	19277	16918	4235	608	53	87	2,88	23	264	110	4,74	8,44	35	55	31
5569	515	14192	24566	6537	581	31	79	9,2	23	265	84	2,58	8,32	31	50	28
5570	219	22613	4555	4773	1041	30	99	6,16	32	260	244	3,74	9,7	24	51	29
5571	5897	10333	197080	4599	1221	58	179	23	65	216	178	3,37	17	39	64	94
5572	5548	12240	158574	4664	1087	71	120	15	39	290	176	2,82	14	41	61	51
5573	216	15554	39388	6547	888	51	128	13	28	232	88	2,91	10	39	55	36
5574	97	12841	3700	3831	1807	59	116	22	42	253	322	4,03	13	40	56	57

Note: measurements 3604 and 3605 were taken for research on the black stains on the tibia, possibly related to scurvy.

5917

OVERVIEW

Number:	5917	/ Crown number:	5918
Reference number:	5917-J-O		
Photo ID:	1320-1335		
Level (put/vlak/spoor):	64/2/2		

SUMMARY

Sex development:	INDETERMINABLE / probably female
Age-at-death:	18-24 years / used method: fusions axial skeleton/dental
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue multiple skull fragments (indeterminable), elements of the crown present
Pathological & remarks:	periostitis on right tibia (medial surface), hypoplasia, abcess in mandible

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: distal end humerus, shaft of the femur, tibia and fibula, 1 rib fragment; *Hand:* 1st - 4th metacarpals, 2nd, 4th and 5th proximal phalanges; *Foot:* talus.	Mandible (right side), skull fragments (indet.), fragments of the right temporal, parietal, frontal and left parietal C2 (dens), 4 L vertebrae, right fragment of the ilium, 23 rib fragments	*General:* shaft of the ulna, shaft of the tibia, 3 rib fragments; *Hand:* 2nd 4th and 5th metacarpal, third proximal and distal phalange; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
I	M	I	I	I	I	I	I		M	I	I	I	I	M	I	I
$R^{3/4}$			h	h	h					h	h	h	h		h	$h/R^{3/4}$
$h/R^{3/4}$	h			h	h	h				h						$h/R^{3/4}$
I	I	M	M	I	I	I	I		I	I	I	M	M	M	M	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

– An abscess is present on the location of 46.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia on the incisors suggests there was a metabolic upset around the age of 2-2,5 years; the location of hypoplasia on the canines suggests this happened again around 3-4 years. The presence and location of hypoplasia on the molars suggests this happened again around the age of 5 years (M2) and 10 years (M3).
- Periostitis is present on the medial surface of the right tibia. Visible is the remodelling of the bone, which is local and sclerotic.

SEX ASSESSMENT

- Not possible due to age, though the pelvis indicators point to probably female

SKELETAL AGE ASSESSMENT

- Age-at-death of the individual based on dental eruption and mineralization was placed between 15-21 years. The M3's have erupted, but their roots are not fully developed yet.
- The annular vertebral endplates had not yet fused, which would indicate an age-at-death between 18-24 years.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Elements of the crown were found between fragments of the skull. These elements, only approximately 1.5cm in length, are copper/iron threads woven around each other. Two larger threads woven around each other form a ring, where other smaller woven rings of the same material have been attached.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1562	5917	skullfrag	green residue geen achtergrond meting mogelijk	37	32	1,49	0,201	0,542	0,007	0,038	1,08	28	52	2,40
1563	5917	skullfrag	green residue/blue-ish stripe on edge of bone	56	41	2,12	0,268	1,59	0,034	0,039	1,64	-2,016	37	1,20
1564	5917	skullfrag	algemene meting (midden bot)	35	32	3,04	0,139	4,22	0,016	0,084	1,53	24	52	1,53
1565	5917	skullfrag	algemene meting (midden bot)	36	33	3,36	0,153	1,74	0,024	0,067	0,886	25	54	1,11
1566	5917	skullfrag	achterzijde bot verkleuring	37	29	2,88	0,051	5,66	0,011	0,096	0,832	25	53	1,81
1567	5917	parietal L	green residue	15	17	16	0,089	9,04	0,037	0,207	1,63	41	56	4,73
1568	5917	parietal L	achtergrond meting	37	32	3,46	0,173	5,50	0,019	0,074	1,70	20	51	0,761
1569	5917	parietal R	green residue, small	34	29	3,02	0,097	2,89	0,024	0,061	1,07	29	55	0,700
1570	5917	parietal R	algemene meting (midden bot)	29	31	9,22	0,106	1,32	0,011	0,078	1,05	27	55	0,508

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1562	888	28524	47258	1949	143	205	202	1,84	22	1,55	57	25	85	25	51	51
1563	1390	33722	20646	2363	57	250	119	1,84	24	5,18	61	45	130	45	68	35
1564	855	19133	24387	3419	149	243	177	1,84	22	1,50	56	24	110	24	48	31
1565	482	19650	8612	2861	147	240	266	1,84	22	1,50	48	26	111	26	49	30
1566	609	19221	10493	483	76	147	133	1,84	22	1,52	53	26	111	26	52	33
1567	767	15285	38029	4573	338	135	283	1,84	22	1,76	168	31	234	31	62	80
1568	776	33346	12366	3616	218	229	118	1,84	26	1,50	60	24	116	24	49	35
1569	1235	28150	23560	3841	572	205	170	1,84	22	1,84	157	29	126	29	58	37
1570	1486	28089	15145	2907	252	209	281	1,84	22	1,50	68	25	178	25	53	45

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
1556	5917	MXX	draadje	87,60	0,03	0,08	3,16	8,63	0,28	<0,1	<0,0	<0,1	0,14		
1557	5917	MXX	indet	75,20	0,03	0,15	5,65	18,08	0,41	<0,1	<0,0	<0,1	0,40		
1558	5917	MXX	draadje	61,44	0,27	0,13	12,17	18,94	0,54	0,18	<0,0	<0,0	5,22		
1559	5917	MXX	onderdeel kroon	92,60	3,22	0,13	0,54	3,08	0,07	<0,0	<0,0	<0,0	0,28		
1560	5917	MXX	onderdeel kroon	46,06	<0,0	<0,0	4,46	48,96	<0,0	<0,1	<0,1	<0,1	0,46		
1561	5917	MXX	onderdeel kroon	78,35	<0,0	0,24	4,14	15,62	0,30	<0,1	<0,1	<0,1	0,78		
x	5.918.001	MXX	koperdraad; fail	94,55	<0,1	1,46	<0,2	0,27	<0,1	<0,1	<0,1	<0,3	3,04	zilver: veel	goud: nee
x	5.918.001	MXX	koperdraad	97,48	<0,0	1,55	<0,1	0,12	<0,0	<0,0	<0,1	<0,1	0,47	zilver: veel	goud: nee
x	5.919.001	MXX	koperdraad	93,67	<0,1	1,48	0,24	0,61	<0,1	<0,1	<0,1	<0,2	2,49	zilver: veel	goud: nee

5931

OVERVIEW

Number:	5931	/ Crown number:	5919
Reference number:	5931-V-VR		
Photo ID:	1527-1554		
Level (put/vlak/spoor):	64/1/1		

SUMMARY

Sex development:	(probable) FEMALE
Age-at-death:	40,33 years ±3 years / used method: COMPLEX
Calculated stature:	178,93cm ± 4,45cm / used method: Trotter & Gleser (hum)
Artefacts/crown/ residue on bone:	blue residue on skull (almost everywhere, concentrated on the posterior-superior aspect of the skull and on the right side) and on some bones
Pathological & remarks:	POA, Poirier's facet, abscess and fistula, caries, hypoplasia, severe dental wear, septal aperture on left side, bad preservation of bones

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humeral shaft and distal humerus, ulna, proximal end femur, medial side patella, 1st and 2nd rib (no sternal end), 3rd rib (no sternal end), 3 rib heads and 5 rib shaft fragments; *Hand:* scaphoid, fragmentary 2nd, 3rd and 5th metacarpal; *Foot:* none.	Posterior side of the parietals, occipital and right temporal (all articulated), fragment of left temporal, mandible, fragments of frontal and sphenoid, both clavicles, lateral-superior aspect of scapulae, C1, C3, 4 T vertebrae, 1 T neural arch, 3 vertebral bodies, lateral sides of the pelvis (ilium and acetabulum).	*General:* humerus, 1st and 2nd rib (no vertebral or sternal end), 4th and 5th rib (no sternal ends), 3 rib heads and 4 rib shaft fragments; *Hand:* trapezium, fragmentary 1st and 2nd metacarpal; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
I	I	I	I	I	M	M	M		M	M	M	M	M	M	M	M
h / 3	h / 2+	h / 2	h	h												
				h	h	h	h		h	h	h	h				
A	A	P	I	I	I	I	I		I	I	I	I	I	P	P	P
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

– Severe dental wear is present as most of the occlusal surfaces show dentine. On the 41 and 42 the pulpa is exposed. Some calculus is present.

- Dental wear between 44-45, 43-44, 32-33, 33-34 and 34-35 is gap-like shaped and indications of smoking tobacco.
- An abscess and fistula are present on the locations of 37 and 41.
- Caries is present on the interproximal contact facets of the 15 and 16.
- Hypoplasia is present on the teeth. The location of hypoplasia on the incisors, canine, and first molar indicated this happened around the age of 3-4 years.The location of hypoplasia on the second molar suggests this happened again around the age of 5 years. In addition, the location of hypoplasia on the third molar suggests there was another metabolic upset around the age of 10-11 years.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on teeth. The location (and multiple hypoplasia lines) suggests there was a metabolic upset at the ages of 3-5 years and 10-11 years.
- There is a septal aperture present on the distal left humerus.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -1. Only the greater sciatic notch and iliac fossa could be scored, as the pelvis was incomplete and fragmentary (scored percentage of 21).
- The sexualization degree of the cranium is 0,14. The skull could not be scored on the facial features. The mandible could be scored on all traits, of which the sexualization degree is 0. In total the skull has a sexualization degree of 0,09 and 65,62% could be scored.
- The sex has been assessed to probable female, as the scored traits are not conclusive.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial suture obliteration and the spongiosa in the proximal end of the femur and humerus. The endocranial suture obliteration was in phase III and the spongiosa in the proximal end of the femur was in phase I. The spongiosa in the proximal end of the humerus was in phase II. This brings the age-at-death to 40,33 years, with an age interval of 3 years.

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser could be used, with the measurement of the left humerus only available. This resulted in a stature of 178,93cm with a standard deviation of 4,45cm.

DESCRIPTION ARTEFACTS

- Except for the blue residue no other artefacts have been found.

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1527	5931	parietal R	blue residue	22	20	11	0,366	22	0,131	0,459	4,38	19	53	0,380
1528	5931	temporal R	blue residue	17	19	13	0,198	20	0,131	0,407	4,11	26	57	0,509
1529	5931	occipital	achtergrond meting	35	31	5,40	0,243	12	0,068	0,190	2,46	14	50	0,442

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1527	382	13555	119	534	644	264	239	2,85	24	1,50	142	32	189	32	54	79
1528	194	15582	138	405	600	196	186	1,84	23	1,59	183	30	220	30	62	45
1529	661	34327	201	784	783	279	174	4,08	23	1,66	171	30	187	30	60	71

6205

OVERVIEW

Number:	6205	/ Crown number:	none
Reference number:	6205-V-O		
Photo ID:	2213-2237		
Level (put/vlak/spoor):	75/1/3		

SUMMARY

Sex development:	6205.1 = FEMALE / 6205.2 = MALE
Age-at-death:	6205.1 = 25-43 years / 6205.2 = 40+ years
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue is present on the left ulna and radius, on 2 thoracic vertebrae, on the right femoral head, both tibiae and a rib fragment
Pathological & remarks:	Probably two individuals, very fragmented, 6205.1: POA hip joints, periostitis, DISH, 6205.2: calculus, enamel hypoplasia, caries, premolar with double roots, maxillary sinusitis, DDD, FAO in low thoracic vertebrae, VOA in lumbar vertebrae

SKELETON STATUS

Present:

Right	General/Skull	Left
General: humerus (no proximal or distal end), radius (no distal end), ulna (no proximal or distal end), proximal femoral shaft and head, patella, tibial shaft, 1st rib shaft fragment, 8 rib heads; *Hand:* lunate, capitate, trapezoid, trapezium, pisiform, 2nd - 5th metacarpal (4th and 5th have no proximal end); *Foot:* navicular.	Both zygomatics, mandible, fragments of the frontal, orbits, maxilla, right parietal, left temporal, both clavicles (no lateral or medial end), lateral border of right scapula, fragment of the C1, C2-C7, 16 fragments of the T vertebrae, 3 fragments of the L vertebrae, S1 and sacrum fragments, right and left ilium (with no iliac crest) with partial ischium and acetabulum. Indeterminable: scapula fragments, humeral head, 2 proximal hand phalanges, 2 metatarsals, 1 proximal foot phalange.	*General:* humerus (no proximal shaft or end), ulna (no distal shaft or end), radius (no distal end), proximal femoral shaft and head, patella, tibial shaft, 5 rib heads; *Hand:* all carpals and metacarpals; *Foot:* fragment of talus, navcular.

Note: pelvis is 6205.1; skull is 6205.2. Long bones probably belong to 6205.1; the spine could belong to 6205.2.

DENTAL (6205.2)

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
I	I	A	A	I	I	I	I		I	I	I	A	A	A	I	I
					h	h	h		h	h	h				3 / c	3-
c		c			h						h	h				h
I	I	I	P	P	I	I	I		P	I	I	I	I	P	A	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe dental wear is present, mostly on the incisors.
- Calculus is present on 27 and 38.
- The upper right first premolar (14) has double roots.
- Caries is present on the 27 (interproximal), 48 (occlusal-distal), and 46 (buccal)

PATHOLOGICAL/REMARKS (6205.1)

- Marginal osteophytes are present in both hip joints, indicating POA of these joints.
- Periostitis is present on the lateral surfaces of the tibiae. The reactive new bone formation is local.
- The patellae are assymetrical.
- Skeletal elements are quite robust, and there are some indications for DISH (DISH related ossifications).

PATHOLOGICAL/REMARKS (6205.2)

- Hypoplasia is present on the teeth. The location of the hypoplasia suggests there was a metabolic upset at the age of 3 years and again at the age of 4 years.
- Marginal osteophytes are present on both the inferior surfaces of the C6 and C7, but DDD is not present. The thoracic vertebrae are very fragmented, on one of the vertebral bodies, probably low thoracic, a Schmorl's node is present; indicating DDD. Ossification of the anterior left ligaments is present on the T10-T12, indicating DISH. Of the lumbar vertebrae, the vertebral bodies could not be inspected. The articular facets could be inspected; VOA is present in the lumbar region. The superior and inferior articular facets of the L2 have marginal osteophytes. The L3 has on the superior articular facets also marginal osteophytes, but on the inferior articular facets erosion (only on the right side) is also present. This is the same (marginal osteophytes and erosion) for the superior articular facets of the L4. The inferior articular facets of the L4 have only marginal osteophytes. For the inferior articular facets of the L5, marginal osteophytes and eburnation are present on the left side.
- Maxillary sinusitis is present on the right side.

SEX ASSESSMENT

- 6205.1: the sexualization degree of the pelvis is -1. In total 52,63% of the pelvis could be scored.
- 6205.2: The sexualization degree of the cranium is +1. The skull could be scored for 50%. The mandible has a sexualization degree of +1,125 and could be scored on all traits. In total, the skull has a sexualization degree of +1,05 and could be scored for 62,5%.

SKELETAL AGE ASSESSMENT

- 6205.1: The complex method was used for an age-at-death assessment, using the spongiosa in the proximal end of the femur and humerus. The spongiosa in the proximal end of the humerus was between phases I-II and the spongiosa in the proximal end of the femur was in phase II. This gives an age-at-death between 25 – 43 years (taken both age ranges in account; 25-34 and 34-43 years). The auricular surface was also used to asses age-at-death. The morphology of the auricular surface came close to phase VII (age-at-death: 50-59).
- 6205.2: The complex method was used for an age-at-death assessment, using only the endocranial suture obliteration. The endocranial suture obliteration was in phase IV. This gives an age-at-death at 40-80 years (40+).

ESTIMATION OF ANTE MORTEM STATURE

- This could not be done due to fragmentation of the long bones.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
2436	6205	fe head R	green residue	36	28	2,27	0,163	5,20	0,023	0,099	0,801	27	55	0,186
2437	6205	fe head R	achtergrond meting	40	26	0,971	0,097	31	0,272	0,485	9,51	-8,950	38	0,545
2438	6205	radius L	green residue radial tub.	32	26	4,79	0,178	20	0,158	0,359	5,86	11	47	0,362
2439	6205	radius L	achtergrond meting	36	30	1,97	0,172	21	0,138	0,374	6,57	3,54	45	0,269
2440	6205	T vertebra	green residue (vertebra with frag. arch)	37	29	2,33	0,051	14	0,090	0,254	3,15	15	49	0,331
2441	6205	T vertebra	achtergrond meting (vertebra with frag. arch)	32	22	2,34	0,176	26	0,209	0,509	5,48	11	47	0,301
2442	6205	T vertebra	green residue	42	33	1,88	0,106	9,13	0,058	0,171	2,34	12	47	0,326
2443	6205	T vertebra	achtergrond meting	37	27	2,42	0,129	25	0,225	0,479	5,92	2,21	44	0,397
2444	6205	rib frag	green residue	35	26	3,77	0,095	26	0,172	0,424	7,90	1,54	41	0,565
2445	6205	rib frag	achtergrond meting	43	29	3,20	0,494	28	0,271	0,513	9,31	-13,591	35	0,367
3468	6205	tibia L	iron-like residue	7,74	14	25	0,033	28	0,11	0,546	2,18	23	55	0,082
3469	6205	tibia L	green residue lateral	38	29	1,34	0,042	3,18	0,025	0,056	2,11	26	53	0,607
3470	6205	tibia L	achtergrond meting	43	33	1,11	0,234	2,51	0,029	0,086	1,3	19	51	0,285
3471	6205	tibia R	green residue medial	29	21	3,88	0,168	13	0,116	0,236	2,52	31	58	0,364
3472	6205	tibia R	achtergrond meting	33	25	3,99	0,419	14	0,152	0,311	3,46	19	52	0,363
3473	6205	ulna L	green residue	31	19	2,79	0,134	19	0,144	0,379	4,46	23	51	0,321
3474	6205	ulna L	achtergrond meting	35	19	1,96	0,516	28	0,275	0,539	6,58	9,11	48	0,336
3475	6205	ulna L	iron-like residue	29	16	2,29	0,45	31	0,329	0,69	5,91	14	51	0,337

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
2436	1827	30727	26158	238	99	292	162	1,84	23	1,77	26	45	74	45	38	78
2437	129	23591	39	308	246	203	193	3,34	23	1,79	66	36	45	36	33	49
2438	136	22221	23786	609	462	436	233	3,63	31	1,50	160	50	94	50	39	78
2439	428	30122	115	414	226	306	364	1,84	23	1,82	62	68	98	68	69	100
2440	611	31832	18907	431	273	256	130	2,56	45	1,50	71	50	69	50	34	47
2441	169	22870	77	548	275	251	207	3,99	31	1,50	62	41	72	41	36	47
2442	856	47584	16799	539	131	259	178	3,07	22	2,16	41	64	66	64	35	46
2443	436	26754	166	497	449	265	112	8,00	80	2,17	102	33	67	33	31	43
2444	1052	24345	28999	580	656	357	118	1,84	27	2,46	202	34	81	34	32	42
2445	590	31233	221	543	381	450	142	5,17	26	6,11	111	46	92	46	42	51
3468	43	8958	120	99	291	108	371	15	92	164	56	1,97	5,37	49	85	162
3469	790	16241	25356	360	569	52	228	1,84	21	276	182	1,5	5,64	54	42	97
3470	345	17920	138	330	250	56	197	1,84	21	287	75	1,5	4,27	39	42	75
3471	283	15150	19155	378	462	54	150	1,84	23	289	163	1,5	5,47	46	43	56
3472	279	14755	214	489	418	51	187	2,76	22	319	128	1,61	5	39	43	66
3473	1174	21033	42268	593	409	54	153	1,96	22	337	155	1,5	5,49	71	43	56
3474	286	16771	251	781	406	51	139	4,3	24	331	125	1,52	4,93	48	40	76
3475	87	18450	275	1160	576	53	213	5,15	33	309	151	1,98	6,3	48	47	56

6211

OVERVIEW

Number:	6211	/ Crown number: 6271
Reference number:	6211-K-O	
Photo ID:	1578-1586	
Level (put/vlak/spoor):	77/1/6	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	10 years ±30months	/ used method: dental/fusions
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue is present on skull fragment	
Pathological & remarks:	very fragmented, skeletal age is "younger" than dental age	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: none; *Hand:* none; *Foot:* none.	Fragment of superior part occipital and right parietal. Both temporals (fragmentary), fragments of frontal, parietal, maxilla, basilar part present, mandible, 1 T vertebra, 3 neural arches, 9 rib fragments; Indeterminable: 3 fragments of long bones.	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	I	I	M	M	I	I	I		M	I	I	M	M	I	I	I
	$R^{1/2}$						$R^{3/4}$								$R^{1/2}$	$C^{3/4}$
$C^{3/4}$	$R^{1/2}$		h/$R^{1/2}$	h/$R^{3/4}$								$R^{3/4}$	$R^{1/2}$		$R^{1/2}$	$C^{3/4}$
I	I	I	I	I	I	M	M		I	I	I	I	I	I	I	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

– The mesial surface of 36 is discolored.

PATHOLOGICAL/REMARKS

– Hypoplasia is present on the teeth. The location of hypoplasia on the lower right premolars suggests there was a metabolic upset at age 5 (with an age range of 16 months). The other premolars which are present do no show any signs of hypoplasia.

SEX ASSESSMENT

- not possible due to age.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed at 10 years with an age interval of 30 months.
- The skeletal age of this individual does not correspond with the dental age. The basilar part of the occipital bone had not yet fused, which would indicate an age of younger than 7 years. Also, the neuro-central junction was still fusing, meaning an age of 3 – 6 years.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1617	6211	parietal	residue	33	29	5,70	0,205	6,33	0,014	0,133	2,27	24	53	1,21
1618	6211	parietal	residue	31	25	6,20	0,192	8,96	0,037	0,172	2,82	26	52	2,06
1619	6211	parietal	achtergrond meting	39	37	2,38	0,251	6,26	0,045	0,127	4,02	11	48	0,483

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1617	320	19352	4553	1974	77	239	99	1,84	22	1,50	95	25	149	25	50	30
1618	337	17713	6075	1810	82	242	82	1,84	22	1,50	107	23	154	23	50	29
1619	699	23798	1327	2356	181	249	98	1,84	22	1,50	66	35	97	35	44	26

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.271.001	MXX	koperdraad	92,06	<0,1	1,60	<0,1	0,07	<0,0	<0,0	0,09	<0,2	5,84	zilver: veel	goud: nee

6260

OVERVIEW

Number:	6260 / Crown number: 6361
Reference number:	6260-K-O
Photo ID:	1386-1399
Level (put/vlak/spoor):	78/1/17

SUMMARY

Sex development:	INDETERMINABLE
Age-at-death:	36,6-41,09 weeks / used method: long bone length
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	green residue is present on skull fragment
Pathological & remarks:	skull very fragmented, but most of the long bones and pelvis are complete

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: humerus, radius and proximal end of ulna, femur, tibia (missing proximal end) – all unfused, 7 rib fragments; *Hand:* none; *Foot:* none.	Left side of the mandible, left petrous pyramid, fragment of the left frontal-orbit, parietal fragments and fragment of the right temporal, 3 epiphysis, 11 vertebral bodies (unfused to their neural arches), 2 sets of neural arches, 10 neural arches, 3 phalanges and 10 rib fragments,	*General:* humerus, radius, femur and shaft with proximal end of the tibia, 6 rib fragments; *Hand:* none; *Foot:* none.

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			M	M	I	I	I		I	I	I	I	M			

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
							U		U							
		U				U	U							U		
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

			M	I	I	I	I		M	I	I	I	M			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

- All teeth not present in the mandible or maxilla. All unerupted permanent incisors have fully developed crowns, whereas all unerupted permanent molars have almost fully developed crowns.

PATHOLOGICAL/REMARKS

- None visible.

SEX ASSESSMENT

- Not possible due to age.

SKELETAL AGE ASSESSMENT

- Based on long bone growth and length, the age-at-death could be placed at 36,6 – 41,09 weeks.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1626	6260	skullfrag	green residue geen achtergrond meting mogelijk	33	24	6,12	0,309	25	0,178	0,418	8,44	3,29	38	1,81

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1626	381	21158	50042	5816	4105	426	92	4,88	25	5,88	1022	28	171	28	58	32

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.361.001	MXX	koperdraad; fail	97,29	<0,0	0,74	<0,1	0,34	<0,0	<0,0	<0,0	<0,1	0,91	zilver: ja	goud: nee
x	6.361.001	MXX	koperdraad; fail	97,86	<0,0	0,61	<0,1	0,32	<0,0	<0,1	<0,1	<0,3	0,75	zilver: ja	goud: nee

6373

OVERVIEW

Number:	6373	/ Crown number: 6392
Reference number:	6373-K-O	
Photo ID:	1400-1409	
Level (put/vlak/spoor):	78/2/21	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	1 – 2,8 years	/ used method: dental
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	green residue is present on skull fragments	
Pathological & remarks:	very fragmented, hypoplasia, mulberry molar	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: none *Hand:* none; *Foot:* none.	Fragment of left parietal, frontal and occipital, both petrous pyramids, various skull fragments, 3 fragments of long bones.	*General:* none *Hand:* none; *Foot:* none.

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			I	I	I	M	I		I	M	I	I	M			
			$R^{1/4}$	$R^{1/2}$			h					$R^{1/2}$				

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
		I					I		I				I			
		$CR^{1/2}$					CR^{c}		$CR^{3/4}$				$CR^{1/2}$			
							$CR^{3/4}$		$CR^{3/4}$					$CR^{1/2}$ / h		
							I		I					I		
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

			$R^{1/4}$	$R^{1/2}$												
			I	I	I	I	M		M	I	I	M	M			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

- All inspected permanent teeth have not erupted.
- Mulberry molar is present.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia on the deciduous incisor suggests there was a metabolic upset around 7 months (with an age range of 2 months) in utero. The hypoplasia line on the permanent first molar suggests this happened again at the age of 1 year (with an age range of 4 months).

SEX ASSESSMENT

- Not possible due to age.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed at 1 to 2,8 years.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the green residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1676	6373	parietal L	green residue	28	28	4,16	0,098	3,11	0,015	0,041	2,30	35	54	0,700
1677	6373	parietal L	green residue (elsewhere on fragment)	32	31	4,21	0,073	5,38	0,022	0,081	2,14	25	50	0,712
1678	6373	parietal L	achtegrond meting	47	38	6,76	0,412	12	0,082	0,264	4,86	-8,810	34	0,385
1679	6373	frontal	green residue / geen achtergrond meting mogelijk	15	20	4,28	0,099	4,20	-0,002	0,061	2,06	54	55	7,22
1680	6373	skullfrag	green residue / geen achtergrond meting mogelijk	26	27	6,36	0,120	2,63	0,005	0,064	1,48	37	57	0,606

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1676	666	18848	82736	4706	417	313	85	1,84	23	1,83	175	35	126	35	52	31
1677	692	32106	64633	3758	2131	295	85	1,84	23	3,05	472	38	131	38	51	30
1678	536	48822	10283	4182	766	425	80	4,54	24	7,72	165	29	178	29	57	41
1679	2507	24890	62576	308	31556	180	129	13	25	2,72	5570	35	166	35	67	65
1680	841	25066	59111	725	346	373	96	1,84	23	2,66	125	30	150	30	50	29

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.392.001	MXX	koperdraad	91,71	0,30	1,52	0,13	0,49	<0,1	<0,0	<0,1	<0,2	4,89	zilver: veel	goud: nee

6451

OVERVIEW

Number:	6451	/ Crown number: 6453
Reference number:	6451-K-O	
Photo ID:	1559-1577	
Level (put/vlak/spoor):	80/1/1	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	7 years ±24 months	/ used method: dental
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	blue residue is present on the right side (fragments of parietal and temporal) and on the left parietal, artefacts include small fragments of glass (glass splinters)	
Pathological & remarks:	very fragmented, hypoplasia, meningitis (chronic)	

SKELETON STATUS

Present:

Right	General/Skull	Left
General: none *Hand:* none; *Foot:* none.	Partially right temporal, right and left parietal, occipital (fragments), both zygomatics, left petrous pyramid, lateral fragments of left and right frontal, mandibular fossa, 10 rib fragments and approximately 10 long bone fragments.	*General:* none *Hand:* none; *Foot:* none.

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			I	I								I	I			

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
	U	I	U	U	I	M	I		M	M	M	U	U	I	U	
	CR^{c}	$R^{3/4}$	$R^{1/4}$	$R^{1/4}$	$R^{1/2}$							$R^{1/4}$	$R^{1/4}$	$R^{3/4}$	CR^{c}	
	CR^{c}				$R^{1/2}$	$R^{1/2}$	$R^{3/4}$		$R^{3/4}$	$R^{1/2}$	$R^{1/2}$					
	U	I	U	U	U	I	I		I	I	U	U	U	I	U	
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

			I	I	I				I			I	I			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

- The right side of the mandible was intact, so the status of eruption could be analysed. The permanent premolars were not visible as the deciduous molars were still in the jaw. Also, the permanent canine on that side was also erupting. All other teeth were not in sockets.
- There is some discoloring present on all second molars, the 15 and 11.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the permanent teeth. The location of the hypoplasia suggests there was a metabolic upset around the age of 2-3 years.
- The individual had meningitis, possibly chronic.

SEX ASSESSMENT

- Not possible due to age.

SKELETAL AGE ASSESSMENT

- Based on dental eruption and mineralization, the age-at-death could be placed at 7 years with an age range of 24 months.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Besides the blue residue, small fragments of glass (splinters) were found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1620	6451	parietal	blue-green residue	27	30	13	0,211	1,08	0,007	0,085	1,11	28	53	1,64
1621	6451	parietal	residue inf-ant	26	19	8,06	0,179	3,21	0,012	0,094	0,477	43	63	0,873
1622	6451	parietal	achtergrond meting	52	44	4,07	0,312	3,37	0,019	0,115	1,47	-5,456	37	0,677
1623	6451	tibia R	green residue	16	13	3,68	0,078	18	0,066	0,278	2,08	47	62	1,83
1624	6451	tibia R	achtergrond meting	46	39	4,60	0,487	4,09	0,015	0,155	1,38	5,22	43	0,465
5551	6451	tibia shaft L	green residue (geen achtergrond meting mogelijk)	22	21	5,24	0,309	16	0,101	0,363	2,4	33	59	0,906

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1620	155	29176	13500	6685	54	206	97	1,84	22	1,79	90	38	221	38	57	34
1621	111	21690	9993	2247	75	197	91	1,84	23	2,39	36	28	200	28	61	33
1622	362	38569	1917	1252	387	335	102	3,82	24	5,05	37	47	169	47	69	37
1623	482	12570	76464	1654	808	218	179	1,84	35	2,35	311	84	135	84	61	65
1624	405	27792	3977	2103	147	411	91	1,84	24	5,14	23	33	159	33	62	33
5551	211	11491	18005	5530	1359	258	148	4,45	24	275	219	1,61	11	41	55	35

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.453.001	MXX	koperdraad + OXX	12,50	<0,0	<0,0	0,11	0,09	<0,0	<0,0	<0,1	<0,0	2,92	zilver: nee	goud: nee
x	6.453.001	MXX	koperdraad	91,95	0,08	1,29	0,26	0,56	<0,1	<0,1	<0,1	0,32	4,10	zilver: veel	goud: ja

6476

OVERVIEW

Number:	6476	/ Crown number: 6470
Reference number:	6476-K-O	
Photo ID:	1587-1590	
Level (put/vlak/spoor):	81/1/3	

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	1-2 years ±6 months	/ used method: dental
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	no green residue or artefacts	
Pathological & remarks:	only dental data present	

SKELETON STATUS

Present:

Right	General/Skull	Left
General: none *Hand:* none; *Foot:* none.	Left pars petrousa.	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

			55	54	53	52	51		61	62	63	64	65			
				I												

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38

										I	I					
			85	84	83	82	81		71	72	73	74	75			

– Based on some slight wear on the occlusal surface, the 72 has erupted. The 73 and 54 both have no wear, which would indicate they have not erupted yet or only recently.

PATHOLOGICAL/REMARKS

- None visible.

SEX ASSESSMENT

- Not possible due to age and no indicators.

SKELETAL AGE ASSESSMENT

- Based on dental, the presence of deciduous teeth and their eruption, the individual was 1-2 years with an age interval of 6 months.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- No green residue or artefacts are present.

XRF MEASUREMENTS

- Only XRF measurements of the crown were taken.

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.470.001	MXX	koperdraad	96,89	<0,1	1,26	<0,2	0,20	0,04	<0,0	<0,1	<0,3	0,58	zilver: veel	goud: nee

6478

OVERVIEW

Number:	6478	/ Crown number:	6479
Reference number:	6478-K-O		
Photo ID:	1489-1503		
Level (put/vlak/spoor):	82/1/1		

SUMMARY

Sex development:	INDETERMINABLE
Age-at-death:	4 years ±12 months / used method: dental
Calculated stature:	- / used method: -
Artefacts/crown/ residue on bone:	blue residue over all skull fragments
Pathological & remarks:	hypoplasia, only skull and dental data present, deformed skull by post-mortem factors

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: none; *Hand:* none; *Foot:* none.	Large parietal fragment, left and right petrous pyramid, left side mandible, 1 neural arch	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

			55	**54**	**53**	**52**	**51**		**61**	**62**	**63**	**64**	**65**			
			I	I			I			I		I				

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
		U		U					U	U	U					
		$CR^{3/4}$		$CR^{1/2}$					CR^{c}	CR^{c}	Cr^{c} / h					
		$CR^{3/4}$		$CR^{1/2}$	CR^{C} / h	Cl^{i} / h	Cl^{i}		Cl^{i}	Cl^{i}	Cr^{c} / h	$CR^{1/2}$	$CR^{1/2}$			
		U		U	U	U	U		U	U	U	U	U			
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

			I		I		I		I	I		I	I			
			85	**84**	**83**	**82**	**81**		**71**	**72**	**73**	**74**	**75**			

– All inspected permanent teeth had not yet erupted.

PATHOLOGICAL/REMARKS

- Hypoplasia is present on the teeth. The location of the hypoplasia on the incisors and the canines suggests there was a metabolic upset around the age of 3-4 years.
- The large parietal fragment is deformed. This is the result of soil pressure and is post-mortem.

SEX ASSESSMENT

- Not possible due to age and no indicators.

SKELETAL AGE ASSESSMENT

- Age-at-death of the individual based on dental eruption and mineralization was placed at 4 years with an age range of 12 months.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to age.

DESCRIPTION ARTEFACTS

- Except for the blue residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1613	6478	parietal	blue residue achtergrond meting niet mogelijk	18	33	19	0,727	1,81	0,018	0,110	0,899	26	56	0,281
1614	6478	skullfrag	blue residue achtergrond meting niet mogelijk	34	35	14	0,487	4,62	0,034	0,132	2,29	9,56	42	1,06
1615	6478	skullfrag	blue residue achtergrond meting niet mogelijk	28	34	16	0,534	1,66	0,023	0,100	1,03	19	50	0,935
1616	6478	residue		14	52	55	1,75	9,02	0,054	0,323	2,58	-34,689	17	0,421

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1613	551	22305	216	1295	107	168	91	1,84	22	1,64	37	31	239	31	56	32
1614	671	24478	3487	6465	691	194	153	1,84	23	1,81	227	40	239	40	59	33
1615	604	32158	292	7789	230	181	167	1,84	23	3,43	80	32	270	32	66	36
1616	544	68588	577	1142	1050	74	234	6,57	53	8,50	155	49	660	49	160	62

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.479.001	MXX	koperdraad	96,60	<0,0	1,51	<0,1	0,14	<0,0	<0,0	<0,0	<0,1	1,55	zilver: veel	goud: nee

6589

OVERVIEW

Number:	6589	/ Crown number:	6591
Reference number:	6589-V-O		
Photo ID:	1629-16432		
Level (put/vlak/spoor):	86/2/9		

SUMMARY

Sex development:	INDETERMINABLE	
Age-at-death:	older than 21 years	/ used method: dental
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	no green residue or artefacts	
Pathological & remarks:	only dental data present, some skull and postcranial fragments	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: none; *Hand:* none; *Foot:* none.	Indeterminable skull fragments, 2 humerus fragments, 1 femur fragment, 1 mandible fragment, 1 radius fragment, 1 fragment of long bone, fragment of acetabulum.	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
I					I						I					
														3+	3	
						I	I					I		I	I	
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

– The third molar had erupted, as it has slight enamel wear.

PATHOLOGICAL/REMARKS

– None visible.

SEX ASSESSMENT

– Not possible due to age and no indicators.

SKELETAL AGE ASSESSMENT

- Age-at-death of the individual based on dental eruption and mineralization was placed at 21 years or older.

ESTIMATION OF ANTE MORTEM STATURE

- Not possible due to absence of the long bones.

DESCRIPTION ARTEFACTS

- No green residue or artefacts are present.

XRF MEASUREMENTS

- Only XRF measurements of the crown were taken.

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.591.001	MXX	koperdraad	77,16	<0,1	0,71	0,54	0,58	0,04	<0,1	0,10	<0,2	19,81	zilver: ja	goud: nee

6749

OVERVIEW

Number:	6749	/ Crown number:	6748
Reference number:	6749-V-VR		
Photo ID:	1504-1526		
Level (put/vlak/spoor): 91/1/7			

SUMMARY

Sex development:	FEMALE
Age-at-death:	25-34 years / used method: COMPLEX
Calculated stature:	155,41cm ± 4,24cm / used method: Trotter & Gleser (radius)
Artefacts/crown/ residue on bone:	green residue above left orbit/forehead, blue residue present on frontal bone (left-superior)
Pathological & remarks:	very fragmented, chronic maxillary sinusitis, periapical abscesses and fistulae, hypoplasia, hyperostosis frontalis interna, synovial plicae left femur and acetabulum, subchrondal cysts on right and left acetabulum

SKELETON STATUS

Present:

Right	General/Skull	Left
General: distal shaft and end humerus, humeral head, radius, ulna, proximal shaft and end femur; *Hand:* 2nd metacarpal and 5th intermediate phalange; *Foot:* none.	Large fragment frontal, right parietal (fragmentary), fragment of left parietal, both zygomatics, inferior side maxillae, superior side occipital, occipital condyles, both temporals (fragmentary), lateral side right scapula, C1, C2 (dens), 1 C neural arch, 3 T neural arches, L1-L3 (posterior sides), S1 (only right side), right ilium with partial ischium, left ilium (fragmentary) with partial ischium.	*General:* distal humeral shaft, radius, ulna, proximal shaft and end femur; *Hand:* 2nd intermediate phalange; *Foot:* none.

DENTAL

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
I	I	I	I	P	I	I	P		P	P	I	I	I	M	I	I
c	3	3	c			h									c / 2+	1
c / 1	3	3														c / 1
I	I	I	I	I	I	I	I		P	I	P	I	P	P	P	I
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Caries is present on the buccal sides of 18, 27, 38 and 48. On the 18, most of the buccal surface is not present due to caries.
- Dental wear is severe on the right upper and lower molars.
- Calculus is present on the labial side of 32, 41 and 42.
- Periapical abscesses are present on the distal roots of the 15, 18, 36 and possibly 35. For the 18 there are two fistulae, one on the buccal side and the other in the maxillary sinus.
- The 12 is shovel-shaped with a pit-like dental hypoplasia present on the buccal surface.
- There is some brown staining on the distal surfaces of the 38 and 48.
- Both the upper second molars (17 and 27) have a morphological variation on their occlusal surfaces.

PATHOLOGICAL/REMARKS

- As mentioned, periapical abscesses are present in the jaw. Besides the two fistulae near the 18 and in the maxillary sinus, there is also new bone formation in the maxillary sinus. This indicates a chronic maxillary sinusitis. The new bone formation is lamellae and mixed (woven and sclerotic).
- Hyperostosis frontalis interna is present, though only slightly.
- In the right femoral head and right acetabulum synovial plicae are present. Subchondral cysts are present on the right and left acetabulum.
- There are some marginal osteophytes present on the vertebral facets of the L3.

SEX ASSESSMENT

- The sexualization degree of the pelvis is -0,75. In total 63,15% of the pelvis could be scored.
- The sexualization degree of the cranium is -0,8, which is 0,33 for the mandible. In total the sexualization degree of the skull is -0,47 and 43,75% could be scored.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using the endocranial sutures and the spongiosa in the proximal end of the femur. The endocranial sutures were in phase I, the spongiosa in the proximal end of the femur was in phase II. The age-at-death range is 25-34 years.
- The epiphyseal line of the iliac crest is still visible, though only slightly. It indicates an age of 20-35 years. The epiphyseal line of the femoral head is also still slightly visible.
- To assess an age-at-death, the auricular surface could also be used. The morphology of the auricular surface came close to phase IV (age-at-death: 35-39).

ESTIMATION OF ANTE MORTEM STATURE

- The method from Trotter & Gleser was used, with the only available measurement (maximum length of the left radius). This resulted in a stature of 155,41cm with a standard deviation of 4,24cm.

DESCRIPTION ARTEFACTS

- Except for the green and blue residue no other artefacts have been found.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
1609	6749	frontal	blue residue on superior surface	29	27	7,88	0,550	1,79	0,017	0,080	0,733	33	58	1,11
1610	6749	frontal	blue residue on superior surface (same as above, taken slightly elsewhere)	18	25	15	0,485	8,50	0,031	0,210	1,94	30	55	2,76
1611	6749	frontal	green residue between orbits	25	24	7,03	0,230	13	0,060	0,222	2,75	28	53	2,41
1612	6749	frontal	achtergrond meting	29	21	4,59	0,358	4,63	0,034	0,122	1,44	39	61	1,11

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
1609	193	19489	3611	3532	65	223	182	1,84	23	2,82	84	31	192	31	62	39
1610	193	19392	6893	3780	165	224	113	2,03	27	1,60	239	39	212	39	55	43
1611	352	19601	37641	560	236	252	156	1,84	24	1,55	127	33	159	33	53	33
1612	220	15645	4109	5903	110	237	98	1,84	22	1,74	63	28	145	28	58	44

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.748.001	MXX	koperdraad	96,78	<0,0	1,14	<0,1	0,20	0,09	<0,0	<0,1	0,17	1,30	zilver: veel	goud: ja

6786

OVERVIEW

Number:	6786	/ Crown number:	6787
Reference number:	6786-V-VR		
Photo ID:	2249-2266		
Level (put/vlak/spoor):	92/2/4		

SUMMARY

Sex development:	FEMALE	
Age-at-death:	30-60 years	/ used method: COMPLEX
Calculated stature:	-	/ used method: -
Artefacts/crown/ residue on bone:	blue residue is nearly everywhere present on the skull, green residue is present on a suture and on the right frontal/parietal, organic residue is present	
Pathological & remarks:	only skull present, enamel hypoplasia, pitting in maxilla, abscess and fistula in maxilla, maxillary sinusitis, cribra orbitalia, TMJ osteoarthritis	

SKELETON STATUS

Present:

Right	**General/Skull**	**Left**
General: none; *Hand:* none; *Foot:* none.	Both zygomatics, fragments of the frontal, mandible, maxillae, both parietals and occipital.	*General:* none; *Hand:* none; *Foot:* none.

DENTAL

18	**17**	**16**	**15**	**14**	**13**	**12**	**11**		**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
M	I	P	P	I	P	P	P		P	I	P	M	M	I	I	M
	2+													3+	2	
											h					
M	M	M	M	M	A	A	A		I	I	I	A	A	P	A	M
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**

- Severe dental wear on most of the teeth.
- Calculus is present on the 14, 27, 27, 33, 41 and 42. It is only present on the buccal side.
- Abscesses are present ath the location of 16 and 21-22, A fistula is also present at the location of 21-22.
- Some pitting is present in the maxilla.

PATHOLOGICAL/REMARKS

- The location of the hypoplasia on the canine suggests there was a metabolic upset around 2.7 years.
- Maxillary sinusitis is present on the right side. The new bone formation is lamellae, local, and mixed. The left side could not be inspected.
- Cribra orbitalia is present in the left orbit.
- TMJ osteoarthritis is present on the right side, left side could not be inspected.

SEX ASSESSMENT

- The sexualization degree of the cranium is -0,41. The skull could be scored for 70,83%. The mandible could be scored for 25% and the sexualization degree is -1. In total the skull has a sexualization degree of -0,47 and could be scored for 59,37%.

SKELETAL AGE ASSESSMENT

- The complex method was used for an age-at-death assessment, using only the endocranial suture obliteration. The endocranial suture obliteration was in phase II. This gives an age-at-death at 30-60 years.

ESTIMATION OF ANTE MORTEM STATURE

- This could not be done due to absence of the long bones.

DESCRIPTION ARTEFACTS

- Except for the green and blue residue there was also organic residue present on the skull, at two locations. The green residue is both present endocranially as well as ectocranially.

XRF MEASUREMENTS

#meas	#ind	location	type	CaO	P2O5	Fe2O3	MnO	SiO2	TiO2	K2O	Al2O3	Bal	Bal (meas)	S
				%	%	%	%	%	%	%	%	%	%	%
4679	6786	frontal 2	green residue ecto	30	22	5,15	0,345	2,1	0,046	0,067	1,08	39	58	2,31
4680	6786	frontal 2	green residue endo	33	17	2,87	0,113	4,18	0,038	0,083	1,31	40	53	9,35
4681	6786	frontal 2	green residue endo extra	33	18	2,63	0,092	3,05	0,035	0,085	1,58	42	55	8,07
4683	6786	frontal 1	green residue ecto	35	25	5,33	0,333	5,42	0,038	0,159	2,19	27	52	3,56
4684	6786	frontal 1	green residue ecto extra	28	14	5,89	0,324	3,84	0,045	0,071	0,544	47	64	1,61
4686	6786	frontal 1	cluster sulf. Endo	29	14	2,99	0,169	13	0,092	0,289	2,23	38	61	1,6
4687	6786	frontal 1	cluster sulf. Endo extra	28	17	4,16	0,187	9,93	0,087	0,238	1,62	39	62	1,59
4688	6786	frontal 1	green residue endo	32	17	2,99	0,184	14	0,096	0,307	3,06	31	57	2,04
4689	6786	occipital L	green residue + OXX ecto	5,59	6,08	6,45	0,207	19	0,132	0,427	1,7	61	66	3,21
4690	6786	occipital L	green residue endo	22	11	2,99	0,138	9,12	0,079	0,213	0,91	53	69	2,34
4691	6786	skullfrag	green residue ecto / geen achtergrond meting mogelijk	22	9,52	4,67	0,301	16	0,068	0,329	2,52	44	64	2,55
4692	6786	skullfrag	green residue endo / geen achtergrond meting mogelijk	33	17	3,63	0,195	9,42	0,07	0,223	1,69	35	53	7,02
4693	6786	skullfrag	green residue / geen achtergrond meting mogelijk	35	26	3,8	0,375	2,32	0,045	0,087	1,08	32	55	2,24
4694	6786	parietal L	achtergrond meting algemeen (voor alle skullfrag)	39	32	3,62	0,316	3,55	0,053	0,067	2,47	19	52	0,465

#meas	Cl	Mg	Cu	Zn	Pb	Sr	Ba	Rb	Zr	Nb	As	Sb	Co	Sb	Ni	Ag
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
											lood overlap					
4679	800	36936	36428	329	716	396	246	1,84	22	278	253	1,82	8,86	43	58	86
4680	437	24760	10049	211	82	60	338	1,84	22	174	24	1,66	5,08	47	61	115
4681	387	36564	8976	215	80	64	353	1,84	22	166	12	1,78	7,78	50	63	159
4683	581	24330	6222	304	133	51	212	1,84	22	285	129	1,54	4,94	46	56	108
4684	285	17309	7610	352	108	54	226	1,84	23	266	117	1,85	5,63	42	62	109
4686	187	18443	2283	263	90	71	309	1,84	24	182	39	2,07	6,24	55	71	158
4687	213	19994	2022	204	86	72	350	1,84	23	189	48	3,03	6,42	55	75	187
4688	210	20185	3026	287	98	67	295	1,84	22	179	49	1,95	7,81	51	66	86
4689	531	11327	74106	25721	1938	487	189	12	71	196	466	3,71	35	59	57	70
4690	178	17749	2279	881	135	107	200	1,84	24	155	61	2,39	6,79	57	76	87
4691	222	21127	6841	381	246	102	222	1,84	23	266	149	1,67	14	44	60	85
4692	478	31500	6804	206	87	58	413	1,84	22	207	50	1,53	4,9	45	60	101
4693	1023	30046	18751	264	488	69	287	1,84	22	258	184	1,5	9,83	43	67	163
4694	1117	25085	92	435	136	47	142	1,84	22	272	43	1,5	4,6	48	52	46

Measurements crown (in %)

#meas	#ind	type	description	Cu	Sn	Ag	Zn	Pb	Sb	Bi	Mn	Au	Fe	Remarks	
x	6.787.001	MXX	koperdraad	96,94	0,06	0,92	<0,1	0,08	<0,0	<0,0	0,07	<0,1	1,75	zilver: ja	goud: nee