Dog companionship in the Netherlands around the Dutch Roman frontier: An osteometry analysis of human-canid relations around the Roman frontier of the Dutch Rhine area

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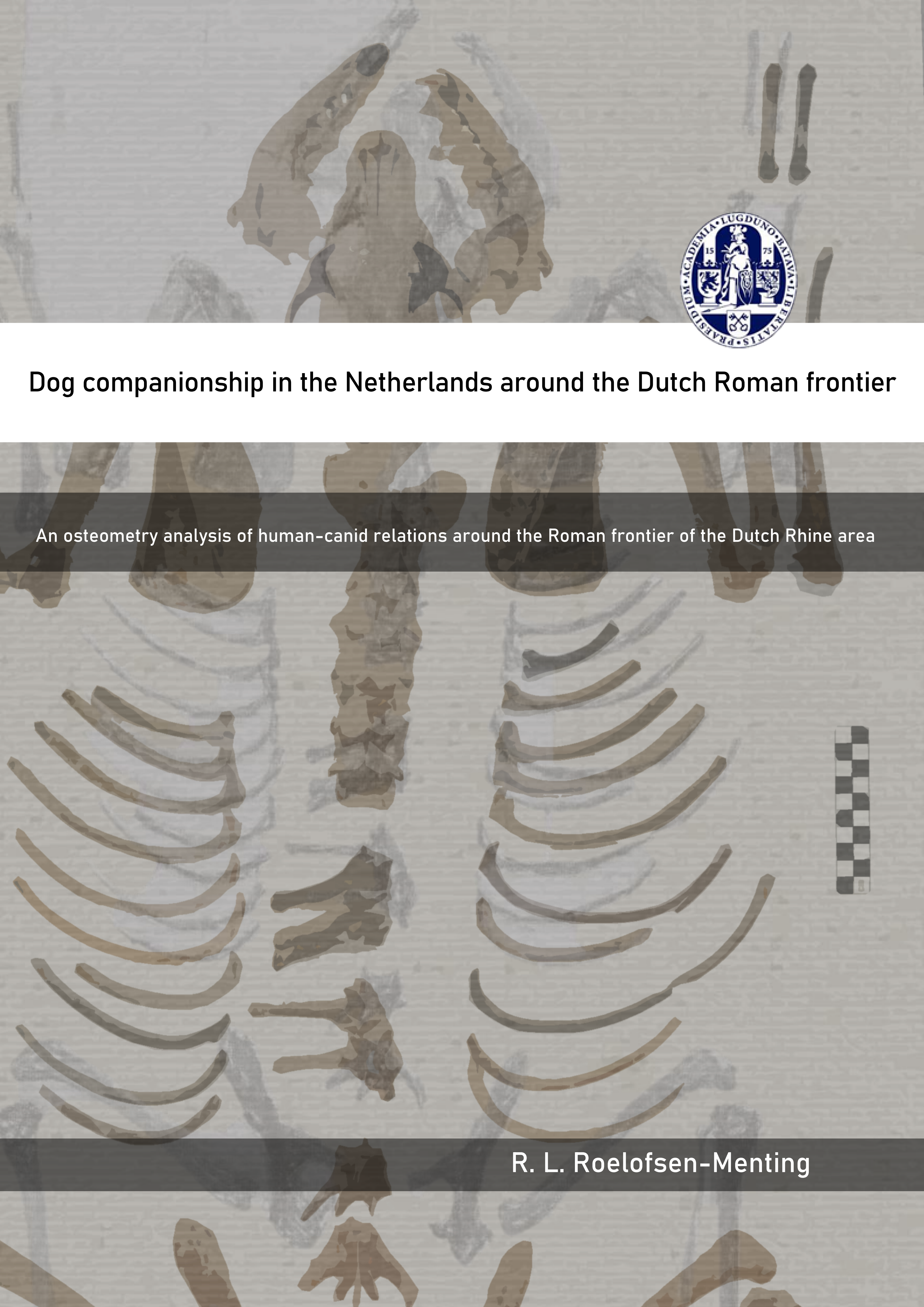

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Dog companionship in the Netherlands around the Roman frontier

An analysis of human-canid relations in the Netherlands around the Roman frontier of the Rhine Delta

A Zooarchaeological analysis and literary review

Master (MSc) Thesis

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As a lifelong dog companion and pet owner I have always considered myself, amongst substantial others, to have a special relationship with a variety of animals, dogs included. I have found the relationship to be of a unique character and have, like so many people, cherished them, lived alongside them and grieved for them. Arguably, the same could have been true for people and their pets in other periods. I decided upon the subject of my thesis to be the dog, partially due to my own experience with this species and subsequently due to the fact that it is a very neglected research topic in the Netherlands. I began my thesis during my first master year, in which I did most of the practical work. I, however, had find a way to make a living after this initial master's year and started my first archaeological job in the Netherlands, which took up most of my time and a considerable amount of my energy. More so, then I initially planned. I therefore halted my efforts to continue my thesis up until a year and a half after starting my job. Hence why I continued on my thesis in my third master's year, in which I focused on the relationships between humans and dogs derived from various sources as a compensation to smaller database.

Completing this thesis would simply not have been possible without the support and help of the best thesis supervisor in the world and amazing archaeozoologist; Laura Llorente Rodriguez. My sincere and deep gratitude is in order. Additionally, I would like to extend my gratitude to Julia Chorus, who provided a major portion of the materials included in this research and supplementary literature. I would also like to express my thanks to the depot manager of Rotterdam Municipality; Peter Kalkman, for supplying additional material and literature. Special thanks must be expressed to my partner: Leon, who has always supported me and helped me, along with my parents; Gerda and Peter, to remain focused. And last but not least, I would like to express my thanks for the assistance of my friends, who remained patient with me, and my colleagues at Econsultancy.

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CHAPTER ONE: INTRODUCTION

The dog (*Canis lupus familiaris*) was the first animal to be domesticated, and hence has a connection to humans for a longer period of time than any other animal, the oldest remains dating to around 17Kya (Hervella et al., 2022). The actual date in which dogs were domesticated, however, is complicated to determine because it does not only convey when humans first began to selectively breed them how long a close association had existed prior to full domesticated features appeared (Messent & Serpell, 1981, p. 6). According to Coppinger & Coppinger, 2002, dogs were domesticated through natural selection by exploiting a new niche, namely human rubbish dump, although it is not clear whether the dog made the choice, or humans or a combination of the two (Price, 2002, p. 24-26). It is, however, continuously undergoing discussion on how long the dog has been domesticated as a result of new studies, which resulted in the current view that it has occurred in several centres of origin. The important changes that such a long domestication endeavours, such as decrease in brain size and function, make their association with humans strongly dependent on them (Price, 2002, p. 176). This interdependence evolved into a special connection as this led to various relationships between dogs and humans (Price, 2002, p. 1). With the rise of various types of relationships, dogs were tasked with a variety of roles such as pet, as hunter, as shepherd, etc. As a result of the location and situation the relationship was situated in, the roles performed differed. As a farm dog, it served different duties than as a dog from a wealthy household (Snyder & Moore, 2006, p. 12-23). There was also frequent overlap between these roles, as these roles were not black and white and highly depended on the humans that the dog served (Fitzgerald, 2009; Grieve, 2012, p. 245-246). The relationships itself was not the only thing that changed, as animals were domesticated (Price, 2002, p. 1-2). In addition to providing companionship and assistance with several pre-existing tasks or those that arose over time, in many ways the domestication of animals transformed both the way humans live and engage their world (Baenninger, 1995; Tanabe, 2001; Price, 2002, p. 1). It is potent to remember that the roles diver throughout time and place, as the life of human's changes, so did their dogs life (Price, 2002, p. 4-5). With regard to the benefits, these relationships between dogs and humans seem to be more apparent to humans (Wingerden, 2013, 35-36).

The purpose of this thesis is to examine the relationship of dogs with humans and conversely in a particular region and period, namely: the Dutch Roman frontier on the banks of the Rhine Delta. This precludes research on the origin of the dogs, but is related to the trend of the domestic dog in the area of the Roman frontier. The aim of this thesis is to explore the relationship between humans and dogs in the Roman frontier area of the Netherlands (ca. 50 BC to 476 AC) and to develop a more accurate comprehension of the manner in which people in the Dutch Roman Delta society perceived, looked after and utilized their dogs. A multidisciplinary approach is used for this study to establish a biography of the treatment of dogs by humans at the six Roman sites in the present-day Dutch Rhine Delta, which used to be the Roman frontier in the Netherlands. The study of the morphology of dogs can provide interesting insights into the relationships that humans and dogs had in the past but ‘A study of animal bones’, as Ervynck (1992) has remarked, cannot by itself provide adequate information and answer all questions about the nature of the relationship between humans and animals. In order to provide the most comprehensive study possible, an in-depth approach has been decided upon.

Functionality, Mythology and Treatment will be the key elements to the research, as was the case in similar research on the human-dog relationship in medieval England and Ireland by Grieve (2012). ’Functionality’ applies to the roles which were performed by dogs as an individual or as the community as a whole in a specific region, specifically, the roles that the dogs could, have been performing during their lifetime due to their size or the chronological, regional or socio-economic context of the site. I would like to emphasize the word would, because a lot of research, predominantly from small surveys establishes a direct link between what an animal could do and what it actually did, which is not the truth in all cases, in my opinion. Clues in the context of a site can be found on whether or not hunting was important to the human group, for example, contributing on the possibility of a dog as a hunting companion. ‘Morphology’ refers to enquiry whether the size and stature of a dog has any correlation with human attitudes towards it. For example, I some small pet dogs may have no other roll in life then to be a companion to the people under whose care they are in. Often those dogs who have no apparent role are given the name: “toy breed”. The smaller dog actually grew in popularity in the Roman era. However, a small dog is not always equivalently a sign of a “toy dog” in all cultures. Smaller sized dogs, one example being the jack Russel, were also being bred for the hunt, since they are very agile.

‘Treatment’ defers to how different cultures treat dogs and especially differs compared with how dogs are treated in modern day society. Care, as mentioned prior, can be highly variable from owner to owner, however, there is always a general norm of regular care that is apparent. This general treatment can be studied though archaeozoological research, creating an indication on how the dogs were seen and in what manner they were treated and cared for during their lifetimes and how they were disposed of upon death.

Religion and mythology were a major component of life for Roman populations (Johns, 2008). While the Romans allowed liberties in terms of choosing religion, many practices and beliefs, as well as traditions, were transferred to any population they came into contact with (Appleton, 2022; Fitzgerald, 2009, p. 40). It is possible that this came about due to the already diverse population of the Romans themselves (Fitzgerald, 2009,b p. 40). The religion of the Roman nation was simultaneously ancient and diverse. In many instances, animals featured in Roman religion (Appleton, 2022). Roman practices were divided into three categories and in each of these categories, animals played a key role as mediums through which humans and the divine communicated (Fitzgerald, 2009, p. 40-41).

In mythology, the deities frequently revealed themselves in animal forms, in fact, many deities in the Roman pantheon had specific animals included in their respective identities. No individuality was linked to the animals, however; they were not beings but rather the suggestions of their attributes. These associations corresponded to the Greek equivalents of the god or goddess. Jupiter had the eagle, Juno the peacock and Minerva was commonly portrayed with her owl (Fitzgerald, 2009, p. 60-61; Toynbee, 1973, p. 251). Quite frequently, these animals were suggestive of the spaces their gods or goddesses inhabited, or the duties of those gods. Diana, for example, was often depicted with hunting dogs or forest creatures such as deer. The dog, which was believed to possess healing properties (Pliny, N.H. 29.14), was sacred to Aesculapius. Animals were not limited to one deity in association; the dog was connected to both Hecate and Aesculapius. The gods were also inclined to use animals as disguises, but in these cases the gods themselves did not become animals.

Those animals that were used in religious rituals and divination were treated as belonging to a different category from ordinary farm animals, and most definitely as distinct from personal animals (Fitzgerald, 2009). Additionally, it is noted by Fitzgerald (2009, p. 53) "while animal sacrifice was very common in the Roman world, it was never a daily routine; the entire ritual of animal sacrifice was a special occasion, likely filled with a variety of feelings". Which, in my own option, is a quite humane approach towards coping with such rituals and therefore likely.

In the case of the Roman period, different archaeozoological studies are known from the United Kingdom (Bennett, n.d.; Bennett & Timm, 2016; MacKinnon, 2010), Spain (Martínez Sánchez et al., 2020) and the Italian peninsula (Mazzorin & Tagliacozzo, 1997). All these studies revealed new interpretations regarding the relationships between dogs and humans through the analysis of dog morphometry, palaeopathology and contextual framework. However, such analyses have been always been isolated cases in Dutch archaeology, therefore, lacking the necessary in-depth research to explore the diversity of dog morphology in Roman times which is ultimately related with human dog interactions. In turn the purpose of this thesis is not to study the origin of the dogs, but how this relationship developed in the Rhine region of the Netherlands during the Roman occupation.

1.1 Objective of the study and research questions

The objective of my study lies in the relationship between humans and their dogs in Roman times. Animals are part and parcel of our world, whether pets, livestock, vermin or wild animals. A variety of animals also inhabited the Roman Empire. Had it not been for the wolf that rescued and nurtured Remus and Romulus, the city of Rome would have never been founded (Addis, 2019). Additionally, there are certain animals linked to some deities, like Minerva's owl, Jupiter's eagle and Hecate's dogs (Hoogeweij, 2018). Between all these animals, the dog, from the perspective of man, enjoys a privileged place in the animal kingdom. It was domesticated first and, through the influence of humans, evolved into the animal we know today (Hervella et al., 2022; Hoogeweij, 2018, p. 4). The dog differs from many other animals in its capability to interact with humans, both through being able to understand commands and abstract, human gestures and pointing, as well as being able to keep people from danger. In addition, by nature, dogs' function in packs, making them well suited to a (human) family or household. Since dogs have coexisted with humans for so many millennia and have been selectively bred by humans for so long, a species has been developed that is capable of coexisting and working well with humans. This thesis falls into the categories of archaeology, archaeozoology and human-animal relationship studies. As such, my aim is to study the relationship between humans from a specific period, namely the Roman period, and a certain species of animal, the dog. A study of humans and dogs can provide new insights into Roman society.

The main research question for this thesis will be to explore the relationships between dogs and humans in the Dutch Roman frontier during the Roman period. This will be approached with the analysis of six case studies.

Such research requires an in depth archeozoological analysis of dog remains and, therefore, secondary research questions will be addressed:

1. What is currently known of the manner in which people considered their dogs, based on Mythology, Ethnographic analogies and osteometric evidence.
2. In which kind of deposits are dogs present in the Rhine Delta region of the Netherlands?
3. How is the morphological diversity of Dutch Roman dogs in the Rhine Delta region of the Netherlands? A detailed morphometrical analysis of dogs from six Roman sites in the Netherlands will be carried out.
4. What was the role of the dogs?

1.2 Theoretical framework

The ability to understand the relation between dogs and humans should be approached in a multidisciplinary framework, since all the methods present flaws in some way. Every method has something which cannot be explained and would therefore have to be supplemented in another way. Each approach can provide more knowledge about the roles of dogs and how they were handled, treated and looked after. However, exactly what kind of dogs were actually kept in the Dutch river areas? That is what needs to be established as a priority. Were they big dogs or small lap dogs? Was the animal in good health, what was its age at the time of death, what kind of sex it had, and so forth?

By examining the relationship between humans and animals, all aspects are considered that provide the foundation of how a society actually functions. After all, gods and animals are also interconnected with each other and, at least in Roman times, there are accounts of creatures in between humans and animals (Hoogeweij, 2018). Deities and mythology are a human construct, thus even the significance attributed to them in conjunction with animals reveals insights into the mindset of the people of that civilisation. One aspect cannot escape the connection with the others. This, in turn, supplies new understanding of the society as a whole. In some cases, the whole is more than the sum of its parts, however in a society, the part may provide a true impression of what the whole encompasses.

In her research, Hoogeweij (2018, p. 12-13) indicates that interesting insights into the human psyche can be demonstrated when investigating the human individual and animals. In doing so, she states that there is a link between individuals who are in the so-called Dark Triad[1] and animal abuse. Animal abuse by young children is a red flag for deeper psychological disorders that have not necessarily manifested themselves yet (Kavanagh et al., 2013). However, the same does not apply conversely: someone who loves animals is not by definition a good person. Nevertheless, this example illustrates all that research on human-animal relationships can reveal about humans (Hoogeweij, 2018). To understand what was involved in the lifespan of the dogs and their subsequent deaths, it is essential to know the motivations of the person(s) in whose care the animal was consigned. The reasoning underlying some recorded findings could narrate the story of the relationship between dogs and humans. Subsequently, a framework can be established of the current knowledge of the population's state of mind and then the possibilities can be determined.

[1] A collective term for people with narcissistic personality disorder, Machiavellianism and/or psychopathic personality disorder (Kavanagh et al., 2013).

1.3 Outline of the thesis

The following sub-chapter will briefly summarise each chapter in the thesis. The first chapter specifies what will be explored during the study as well as the main research questions. Chapter two includes the archaeozoological knowledge with a focus on the Netherlands and the manner in which archaeologists and the archaeozoological specialists have been collecting dog materials. To perform this research, the Roman dog remains from the six sites along the Limes were studied and analysed at the Laboratory for Archaeozoological Studies of the Faculty of Archaeology of Leiden University. Several different methods were applied when examining the skeletal material. To evaluate the Taphonomic history of the dog deposits and thus the treatment of the dogs after death. In order to assess the mortality profiles of the individual dogs, this is an indication of the domestic practices that influenced the treatment of these animals. To investigate the morphology and role of dogs, detailed morphometric and palaeopathological analyses were conducted, followed by an in-depth contextual framework of the remains. Next, palaeopathology gives us a very different perspective on the dog's life and how it was treated.

Chapter three includes an introduction to the origins of domestication of dogs and then continues with the introduction and spread of the species in the Roman Empire. Subsequently, the introduction and spread of dogs in the Dutch Rhine Delta during the Roman period will be addressed. Additional information on exceptional burials, evidence of dog consumption and remains of dogs which have been modified will be evaluated. Finally, this chapter will be concluded with an overview of the ethnological theory of perspectivism.

Chapter four provides an overview of the sites which constitute the backbone of this research. A summary is provided of the number of individuals in the assemblage, the minimum number of individuals represented, the proportion of dog remains within the total assemblage, and the archaeological context of these finds.

Chapter five is concerned with the methodology applied in this study. It outlines the principles and protocols for carrying out archaeozoological analysis techniques, such as determining mortality age profiles, morphological reconstructions, and bone surface modification studies.

Chapter six describes all the results of the archaeozoological analysis, which utilizes the methodology of chapter five with the use of the material described in chapter four.

Chapter seven will review the results of this study, including the limitations.

Chapter Eight features concluding statements on the archaeological significance of the research and the applicability of a multi-disciplinary approach to gain a more comprehensive insight into the relationships between humans and other animals. The chapter also includes assessment of the possibilities for future research.

CHAPTER TWO: ARCHAEOZOOLOGY

The study of archaeozoology concerns animal remains in archaeological contexts and has been undertaken for over 60 years (Lyman, 1987, p. 125). The aim for this specialized research is to gain a better understanding of the relationship between humans and their environment. However, more importantly the relationship between humans and other animal populations. Zoologists rely on the combination of natural sciences and social sciences such as history and the humanities for concepts, methods and explanations (Silibolatlaz, 2009, p. 3).

In addition, the focus of the study lies on the contribution of the animal to the human population. An individual may not have interacted with humans throughout its lifetime, but may mainly have been hunted for food or for some other objects that can be harvested from the body. The collection and production of meat and other animal products, and the consumption habits of humans, are among the most obvious. Assistance throughout human endeavours, protection, artisanal practices, religious and semiotic systems and ceremonies can also be revealed by the analysis of animal bone assemblages (Kunst, 2015). Hence, while some animals may be of importance in life and death, others may be of importance only in death when studying the human population and its behaviour. In every aspect of the study of archaeozoology, the human population starts at its centre.

In order to achieve this knowledge from animal bone assemblage certain analyses are used. The first and most known is taxonomic identification, where the species of the assemblage are examined. Furthermore, archaeozoological analysis entails the measurement of certain elements to reconstruct the size, age and sex of animals or to ascertain to what extent they were wild or domesticated, the quantification of faunal remains to derive the relative significance of the different species, and the analysis of various Taphonomic marks on animal bones that may be associated with settlement patterns, animal or human activity (Živaljević, 2015, p. 675-694)

2.1 Archaeozoology in the Netherlands

The archaeozoological practices in the Netherlands have been quite similar to the practises elsewhere in Europe and have thus been part of standardization (Çakirlar et al., 2019, p. 1-3). These practises have been conducted for over 50 years, as it has been more than 50 years since the late Prof. Anneke T. Clason published her dissertation, Animal and Man in Holland's Past (Clason, 1967). Archaeologists at both public and commercial institutions are committed to utilizing reference collections across the country, which are located in Amsterdam (Department of Archaeology, University of Amsterdam), Leiden (Faculty of Archaeology, Leiden University), Groningen (Groningen Institute of Archaeology, University of Groningen) and Amersfoort (Rijksdienst voor het Cultureel Erfgoed (RCE), the Dutch government's cultural heritage agency).

Archaeozoological research in the Roman period primarily explores the scale and extent of the Roman involvement on the production and consumption of animal products in the "Dutch part" of the Roman Empire (Çakirlar et al., 2019).

Archaeological research has taught us a considerable amount regarding the production of food by farmers on behalf of the military and urban residents in the "Dutch" part of the Lower Rhine Delta (Çakirlar et al. 2019, p. 9; Groot, 2008b; Kooistra, 2013). Wild mammals and birds were of subsidiary importance as a source of meat, despite their increasing symbolic importance (Çakirlar et al., 2019, p. 15; Lauwerier, 1988). This is researched and confirmed by Groot in her studies of the Dutch river region at both producer level (rural) and consumer level (military and urban) (Groot, 2016). Other animals, such as cattle, became very important for various materials, which were harvested in an almost industrial character (Çakirlar et al., 2019, p. 9). Indications of luxurious foods have been encountered at several sites. However, despite these luxury foods the diet kept much of its Iron Age traditional character. Consumption of meat consisted predominantly of beef and lamb. At military sites, more pork was consumed than lamb or mutton (Groot, 2017, 2016). Hunting and fishing might have contributed to a diversified diet. However, their part was insignificant measured in terms of calories (Çakirlar et al., 2019, p. 9).

An increasing level of interest in dogs, as well as in animal bones in general, first developed in the late 1960s and early 1970s. Many remains of canines previously found at archaeological sites had simply been disposed of without them being registered. Only exceptional finds, such as complete skeletons discovered in unusual contexts, were listed in the final results.

CHAPTER THREE: DOGS IN ARCHAEOZOOLOGY

3.1 The origins of the domestic dog *(*Canis *lupus familiaris)*

The domestication of the *Canis lupus familiaris,* i.e., the dog, is a subject that has attracted the interest of many researchers. This makes it a unique specimen that can be used in various ways to scientifically study the process of domestication and humankind's behaviour towards this domesticated animal. It is currently believed that the dog was the first animal to be domesticated, which in itself renders it a more intriguing animal (Brackman, 2021; Brewer et al., 2001; Lear, 2012; Wallace-Hadrill, 2008; Yong, 2016). When Charles Darwin studied the subject, he considered the jackal (*Canis mesomelas*) the ancestor of the dog after his research in the matter, although he also considered the American Coyote, *Canis latrans*, and the African Hunting dog, *Lycaon pictus*, to have played a role in the domestication process (Brackman, 2021; Darwin et al., 1981). However, employing comparative, behavioural and molecular approaches a clear evolutionary relationship has been established between the wolf (*Canis lupus*) and the dog instead (Benecke, 2001; Brewer et al., 2001; Leonard, 2002; Olsen, 1985; Savolainen, 2002; Vila, 1997). Subsequently, studying not only the behaviour of the animal, but also the behaviour in conjunction with human presence through time could be a very interesting way to create a reflection on the world in the past.

The family Canidae (Fahey & Myers, 2020) consists of 16 genera and 36 species, which include foxes, wolves and coyotes (Sillero et al., 2004, p. 232). The family is mainly defined due to their stereoscopic vision, keen sense of smell, capability of hearing a broad selection of frequency ranges, length of the limbs and digitigrade feet used for fast, long-distance running. In addition, most members of this animal family are intelligent, social and natural hunters living in packs (Brewer et al., 2001; Sillero et al., 2004, p. 232-233). Some of the latter behavioural features have been pointed out as pre-adaptative for domestication (Price, 2002, p. 23).

Many studies are still being conducted as to why wolves were domesticated. A very common theory is to help humans hunt or to protect and guard the area which was inhabited by humans (Brewer et al., 2001). However, some authors refer to them being a source of food in some cases or, as dogs are considered impure, as a “purifying agent” (Mainoldi, 1984). This consumption seems to add oddities to the prior knowledge and dogs have probably been consumed in periods of starvation when other animals were no longer available (Messent & Serpell, 1981, p. 5-9). The mention of the impure nature of dogs could be a connection between religion, as dogs had a strong connection to the underworld (Jenkins, n.d.; Mainoldi, 1984; Menache, 1997, p. 114-123).

A reasoning behind the fact that dogs have been used as guardians of a human inhabited area can be found the way dogs differ from wolves. Firstly, dogs use their bark more often when protecting their what they consider their domain. This territorial behaviour is also present in the wolf, but it is far less frequent It is therefore presumed that this trait was deliberately selected by humans. The uses of barking can be utilised when guarding, but also to scare pray when hunting. As dogs hunt in packs by nature, using them in cooperative group hunts would be natural. This would additionally stimulated in their training (Messent & Serpell, 1981). Other benefits from utilising dogs while hunting would be tracking the scent of prey, to keep prey at a distance, as well as to be able to increase the amount of prey a hunter could catch (Russell, 2014). However, this notion has been refuted by scholars as a solely matter that had occurred as a reason for domestication. It was rather a development that took place after the dog was domesticated (Russell, 2014).

Domestication is, in all probability, a result of a process of a special kind of co-evolutionary mutualistic relationship that is perceived sometimes as a type of symbiosis (Zeder, 2006, p. 111). Whether this symbiosis can be defined as commensalism symbiosis can be argued, as scavenging dogs could have been tolerated by humans. This tolerance could occasionally have been an inconvenience. Subsequently, humans and dogs grew into a closer knitted group, which led to an intimate relationship between the two species (Russell, 2014).This behaviour corresponds with mutualism, due to the fact that both species benefitted from this alliance.

As time passed this alliance brought changes. As a result of cohabitation with humans, dogs obtained more reliable sources of food and access to shelter and warmth. Humans reciprocally gained companions in hunting, herding and guarding (Johns, 2008). Dogs ultimately became smaller and more docile in comparison to their ancestors. As a result, dogs had a weaker physique and were more susceptible to a variety of diseases (Serpell, 2016).

3.2 Introduction and spread of dogs in the Roman empire

In Antiquity, Greeks used to keep handbooks concerning dog breeding and the Romans continued this practice (deSandes-Moyer, 2013, p. 93-117). However, subjects such as hunting and religious roles of the dog are also mentioned. How these writers depicted the dogs can express what the social position in addition to their roles was (deSandes-Moyer, 2013; MacKinnon, 2010, p. 292).

The first known people to have owned dogs for the purpose of keeping a pet animal would have been the ancient Greeks and the Romans. While it may be true that this had been the case before, these people were part of cultures which exemplified this concept towards certain animals (MacKinnon, 2010, p. 292). Throughout the Roman era, more was written about dogs. They participated in a broader selection of life categories, based on literary contexts, such as hunting, guarding, shepherding, draught and being kept as a household pet and companions as an inclusion to the household. Different types or morphotypes of dogs, adapted to each of the roles in which they performed a part, were also identified in the ancient sources. Nowadays, dogs vary quite substantially to each other, but the Roman dogs - such as the so called Epirote and Laconian dogs (also known as the 'Molossus'), which were used for herding amongst other things (Cato et al., 2006) – differ very little one from each other. The shepherding dog is described as having a "large head, large and drooping ears, thick shoulders and neck", which does not resemble most of the current shepherding dogs. Additionally, the dog's activity is stated as "monitoring/guarding" and "following" the herd, as opposed to moving it or keeping it together (Anderson, 1985, p. 93). When referring to a role with a specific term, it is, therefore, worth bearing in mind that the meaning behind the term can vary considerably over time.

In Rome, the working dogs were either broad built, massif or lean, greyhound like dogs (Cato et al., 2006; Fitzgerald, 2009, p. 20). Regional differences were mentioned, such as a tall, short-haired dog introduced in the eastern part of the empire, which specialised in boar hunting (Fitzgerald, 2009, p. 21; Toynbee, 1973, p. 103). A Cretan breed was mentioned closer to Rome, which were long and lean dogs (Toynbee, 1973, p. 103). Moreover, different dog types are described in various regions of the Roman Empire. Some of the breeds that gained and lost popularity, for example due to their hunting skills, while others had a constant popularity because of their various roles in and around the house (Fitzgerald, 2009).

3.3 Introduction and spread of dogs in the Dutch river area

The first documented domesticated animals in the Netherlands have been uncovered from approximately 5400 BC (Çakirlar et al., 2019, p. 6). Faunal remains of cattle, sheep and pig with morphometric variations that represent a domesticated animal have been found in the Dutch wetlands between 5400 and 4000 BC (Çakirlar et al., 2019; Oversteegen et al. 2001).

During the metal ages (The Bronze age - 2000-800 BC and the Iron age - 800 – 12BC), the terrain became better suited for animal husbandry; big open spaces with grasslands came into being and people generally lived in farmsteads with previously mentioned animals and dogs (Çakirlar et al., 2019, p. 13). A shift in the way of life took place when Humankind went from foraging to farming and animal husbandry and, in addition to this shift, a new manner of implementation had emerged due to technical innovations. Hunting remained a part of food gathering, but people hunted less compared to earlier periods. This is reflected in the wide range of wildlife species that were still present.

(Amerongen, 2016, p. 96–104). This new human lifestyle also entailed a change in the dog's role in those settlements. It went from, mostly, a hunting companion to shepherding or guarding, for example. As such, the morphotypes of these early Dutch dogs would probably be either large or medium size individuals as reported in different European morphological analysis for these periods (Horard-Herbin et al., 2014).

The influence of the Roman Empire, which began in the Netherlands in the last decades of the first century BC, was mainly present in the South (Çakirlar et al., 2019, p.8). The type of animal husbandry which was introduced during the Bronze Age, continued during the Iron Age and most likely persisted in the rural areas up to the Middle Ages (Çakirlar et al., 2019, p. 8-9). However, new domestic animals, such as chickens, were introduced during the Roman era within the Empire's territories and outside its territories as finds in sites north of the Rhine suggest (Zeiler et al., 2013; Knol, 1983; Lauwerier & Laarman, 1999; Prummel, 2013).

Consequently, the dog's roles have diversified even more since metal ages. This, together with the currently long domestication period, led to great morphological diversity (Brassard et al., 2022; Gene, 2018, p. 14-15). Although dog morphotypes have been investigated in different European regions and periods (Gene, 2018, p. 14; Stone et al., 2016), there is no overview of how this diversification took out in the Netherlands, in general, and in the Roman period, in particular. In order to have an idea of the potential array of dog morphologies, different roles and activities of these canids are presented next.

3.3.1 Dog burials in the Rhine Delta region of the Netherlands

Ritually deposited remains of a range of species, which originated in the Late Palaeolithic in other European regions (Janssens, 2018), appear for the first time in the Netherlands during the Bronze Age in peat bogs and stream valleys (Çakirlar et al., 2019, p. 13). These deposits grew in number after the Bronze age, but only a few animals were buried within a human grave, which mostly consists of cattle remains. However, one grave, which was dated in the middle bronze age, contained two cremated dogs (Prummel, 2013).

As the role of animals grew to be of greater importance during life in the Iron age and Roman period in the Netherlands, so did it grow in the burial tradition. The majority of deposits dating from Roman period includes cattle, sheep, horses, dogs, pigs, red deer and crows (Çakirlar et al., 2019, p. 14). These deposits were frequently discovered in proximity to farmhouses. Located very closely to enclosure ditches, inside ditches of field systems, as well as inside wells. Animals would have been offered for a variety of purposes (Çakirlar et al., 2019, p. 14; Groot, 2007, 2007; Van Giffen, 1963; van Haasteren & Groot, 2013; van Londen, 2006).

3.3.2 Evidence of the consumption of dogs

After dogs were domesticated, they spread rapidly over the world and consumption in Southeast Asia, Indochina, North and Central America, parts of Africa, the Pacific islands and Europe started to occur (Podberscek, 2009, p. 620). Clutton-Brock (2012) argues that as the habitats of human and wolves began to overlap, humans most likely would have killed wolves and occasionally consumed them as well (deSandes-Moyer, 2013, p. 11).

The hypothesis of dog consumption during the Roman period in the Netherlands was tested in research on a Roman bathhouse located in Heerlen (Groot, 2020, p. 17). The examined dog remains show cut marks, but these have also been categorised as skinning marks as there are no further indications that dogs were eaten in the region (Groot, 2007, p. 60). Researchers have concluded that dogs probably served no role as a source of food; in any case, there is no evidence that their meat was eaten in Heerlen or other excavations conducted in the Netherlands around the river region. However, as the dogs that have been found do have markings on their skeletal remains, a possible conclusion could be that dogs were skinned after their deaths. The same conclusion has also been made during research on faunal remains excavated in Tiel-Passewaaij (Groot, 2008a).

3.4 Ethnographic analogies

"Ethnographic analogy, the use of comparative data from anthropology to inform reconstructions of past human societies."(Currie, 2016)

This chapter explores representations of the dog from textual and iconographic evidences in Roman times. During the Roman period, the dog had a variety of roles and was depicted in multiple ways in textual and iconographic sources. Through understanding the manner in which the people of the past generated and produced their art, it is possible to begin to appreciate their perspective on animals in general and dogs in particular. Animals were a primary theme in all forms of art during this period, and animal embellishments were applied with variety and intricacy, exemplifying the many different functions animals performed in the society (Grieve, 2012, p. 1).

3.4.1 Linguistic representations of dogs in the Roman empire

Approximately twenty inscriptions have been found in the corpora that certainly refer to dogs. These inscriptions are epitaphs: some tombstones include merely the name of the dog with possibly a representation of the animal attached, others are quite elaborate and include a considerable amount of information about the deceased animal's life (Hoogeweij, 2018). These inscriptions can only mean one thing, there was a person who loved the animal that died. It wasn't cheap to buy such a gravestone and inscriptions. Most of the inscriptions are made in poetry, likely made by a professional, who had to be hired.

In literature works, the most commonly mentioned dogs are those that have the role of guarding the property. However, dogs were also described without a role. Odysseus' dog Argus remains to be one of the earliest records of a pet in Greek writings (Homer 17.301-2). While the Greeks pioneered writing manuals about dogs, the tradition was continued by the Romans. A big part mentions dogs in a positive manner, stating the loyal behaviour of the dogs that stay by the side of their owners (Ovidius, Fasti V.133-145; Leeman (translator), p. 29). Protect and accompany them as they do their errand's and even remain with them as they lay on their deathbeds (Quintus Curtius, LCL 368, p. 428-429). Cicero describes in writing how the road is considered unsafe at night, but fortunately a woman had an outstanding guarding dog at her side (Cicero, Epistulae ad Quintem fratrem, 27.7) These situations have been mentioned in different kinds of literature works, including plays. There is also quite a substantial number of sources which mention the negative side of dogs. Predominantly used as swear words as well as expressing hatred towards a person (Hoogeweij, 2018, p. 27-28).

3.4.2 Depictions of dogs in the Roman Empire

Representations of dogs known in the Netherlands consist primarily of depictions of a goddess, Nehalennia. Nehalennia was a goddess of fertility and the patroness of home and hearth (Figure 1). She was also patroness of sailors. Shippers, ship owners and merchants who traded with England (Britannia) dedicated hundreds of altars to her. The temples dedicated to her that we currently know are located in today's province of Zeeland, at Colijnsplaat (North Beveland) and Domburg (Walcheren). In appreciation of a safe voyage, sailors and traders had altars erected at these sites. On this altar, a dog is clearly recognizable, symbolizing loyalty and trustworthiness (*Nehalennia-altaar*, 150 C.E.).

Figure 1 Nehalennia Altar (Nehalennia-altaar, 150 C.E.b; Nehalennia-altaar, 150 C.E.a) The goddess is depicted seated on this altar holding a basket of fruits and a dog alongside her. The fruits refer to the protection of agriculture, the dog is a symbol of faith (Nehalennia-altaar, 150 C.E.).

In addition to the representation of dogs on altars of the goddess, depicting different sizes of dogs, figurines, toys and, potentially inadvertently, signs of presence in the form of a paw print have been found (Figure 2; Figure 4; Figure 5; Figure 6 ; Figure 3).

Figure 3 Figurine of a greyhound (Beeldje van een hazewindhond, 270 C.E.).

Figure 6 Toy of a small bronze dog (speelgoed; beeld; hond, 250 C.E.).

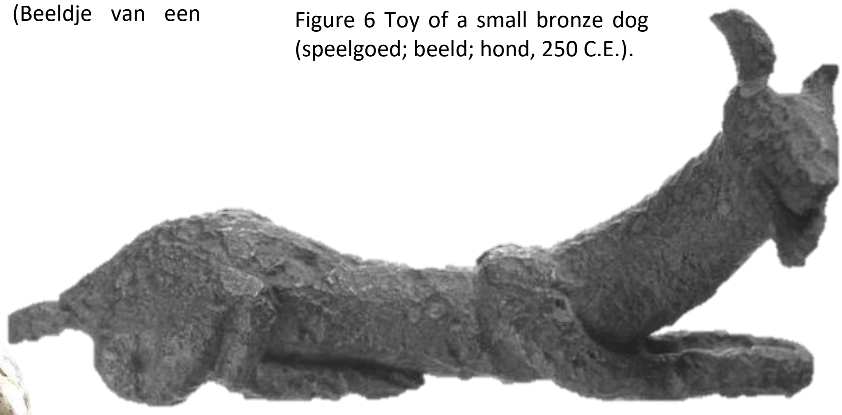


Figure 5 Bronze figurine, laying dog (Beeldje van een hond, 300 C.E.).

Figure 4 Figurine of a dog (Beeldje van een hond, 125 C.E.).

Figure 2 Terracotta statue of a woman with dog seated on a horse. Most of the horse has been lost (beeld van Epona, 175 C.E.).

Whenever an item is created or paid for, there is always an interest on the part of the individual who created it or paid for it. With the altars it is due to safety for health and for the financial situation of the individual or the community. In doing so, this interest is a connection pivotal to the loyalty and trust of the dog. When given form in this manner, it can hardly fail to manifest itself in the general thinking of people regarding the dog. This may also be carried through to making children's toys in the shape of a dog and other figurines.

There is almost no indication on the statues nor on the dogs in the altars of wearing a collar, despite it being used in Roman times. Only the small statue of the bronze dog might suggest a collar around the neck. Fitzgerald (2009, p. 74) mentions that the collar is an attribute of the dog being a pet, which would indicate other customs in the Nederland’s than in other region or the possibility of these dogs not representing pets. Additionally, it can be noted that there were small dogs or puppies, as depicted in Figure 6, Figure 4 and Figure 2 as well as large slender dogs, such as Figure 3 and Figure 5.

CHAPTER FOUR: SITES AND MATERIALS

Included in this chapter are the excavation sites and the materials found there, which have been used for this paper. Prior to commenting on the assemblage, it is imperative to be acquainted with the results of the excavations about the people who had inhabited the settlements as well as the historical and geographical context thereof (Groot, 2007).

4.1 Introduction to the sites and materials

Dog remains from six Roman excavation sites from the Dutch Rhine area serve as the primary focus of this paper. The excavations were carried out in cities or town of Leiden, Alphen aan de Rijn, Spijkernisse, Vlaardingen, Den Haag and Tiel-Passewaaij (Figure 7). The material found during these excavations has been subjected to archaeozoological research (Carmiggelt, 1998; Dijk et al., 2009; Döbken, 1992; Groot, 2007; Hazenberg, 2011; Polak, 2004) and literature review to produce research which can contribute to human animal relationship studies. The material from the six research locations has been added as additional bone measurement to complete a dataset that can provide a firm foundation for this research.

The amount of detailed information in the reports on animal bones, if written at all, was somewhat difficult, as many report specialists had different agendas and frequently concentrated on consumption-related species, with only brief mention given to other mammals and birds. Many finds failed to contain information on the completeness of the dogs, their ages, and whether there was any indication of butchery or pathology (Carmiggelt, 1998; Dijk et al., 2009; Döbken, 1992; Grieve, 2012; Groot, 2007; Hazenberg, 2011; Polak, 2004)

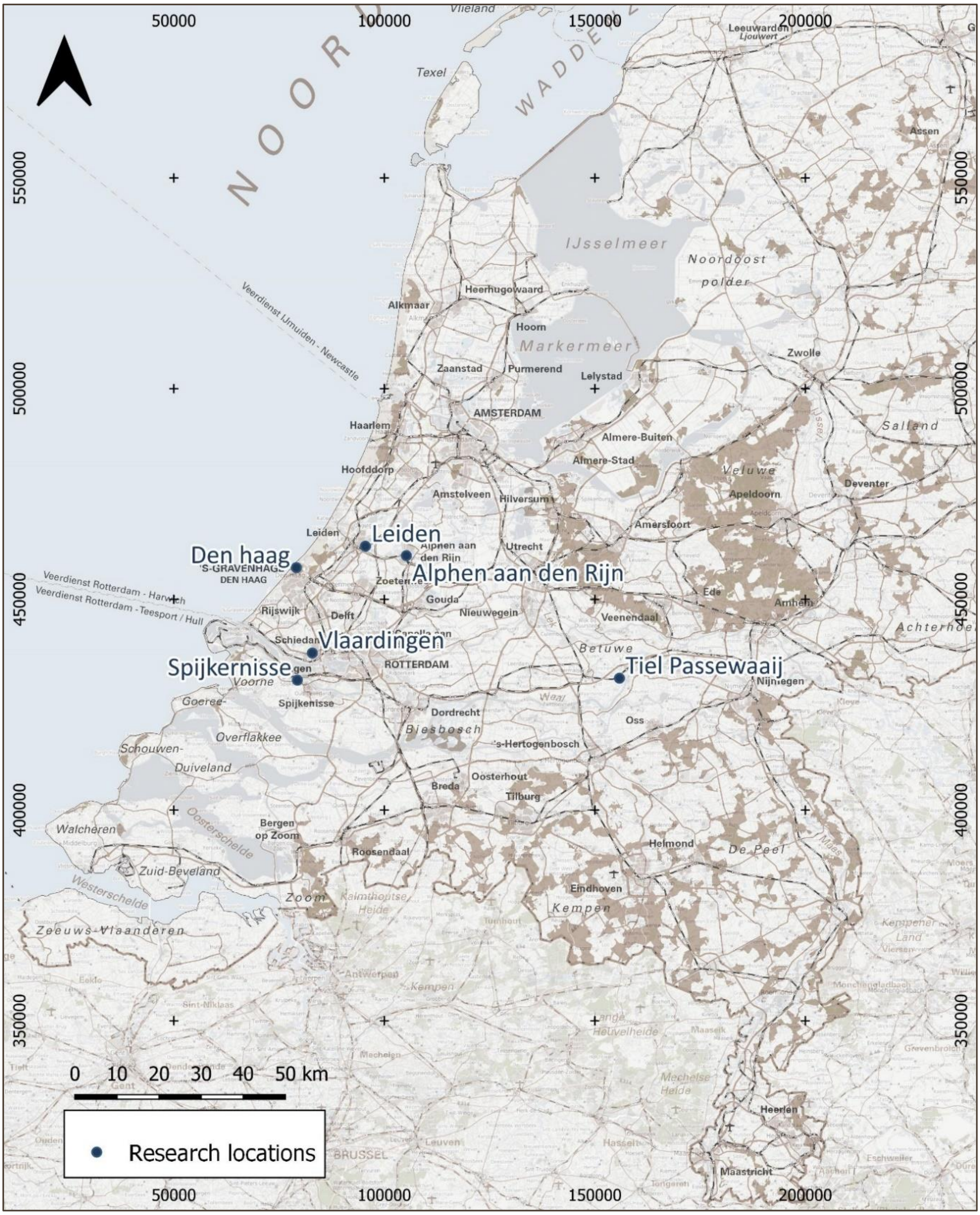


Figure 7 Map with the six research locations, which are included in this research. The are of research that has been selected is the Dutch river area, mainly focussing on the estuary of the river area (by R.L. Roelofsen-Menting).

4.2 Site locations and excavation history

In this chapter, the sites of Leiden Roomburg, Alphen aan den Rijn, Spijkernisse, Vlaardingen, Den haag and Tiel-Passewaaij will be reviewed, with an emphasis on the fundamental data of the excavation, such as how it came about, in what manner it was excavated and what the soil composition of the location is. Then, after the small introduction described above, a brief overview of the fanaul remains and the details known to exist will be given.

4.2.1 Leiden Roomburg

The research area of Leiden Roomburg is located on the map sheet 30F of the topographic map of the Netherlands, scale 1:25.000 and coincides between coordinates 94.880/465.150 and 95.590/462.410. It is situated on the south-eastern urban border of Leiden in the Room or Meerburgerpolder, south of the residential area of Meerburg. The polder is surrounded by the Rijn and Schiekanaal, the Hoge Rijndijk and the Willem van der Madeweg. The ground level during the excavation was approximately at about the NAP-level (Hazenberg, 2011, p. 7).

The monument that is protected by law in Leiden-Roomburg, containing the castellum Matilo and the adjacent civil settlement, as part of the Limes; the series of fortifications that marked the northern border of the Roman Empire from approximately 50 to 270 AD. At the end of the 1st century, the north-western part of this border zone was established as a Roman province, Germania Inferior, which was divided into several civitates or tribal areas. Matilo belonged to the civitas Cananefatium (Hazenberg, 2011, p. 7). The archaeological research that was carried out in the Roomburgerpolder from 1995 until 1997 resulted in a vast amount of data (Hazenberg, 2011, p. 41). The majority of the finds have only been roughly worked out or not at all. Nevertheless, the analyses of the soil traces and the finds have made it possible to establish the broad outlines of the excavation site's past.

The examined section during the present campaign represents the border zone to the west of the castellum and borders the lower, marshy hinterland of the banks of the river Rhine and the creek that is part of the Corbulo Canal. The subsoil is composed of sulphur and clay with deposits of sand found in the lower layers (Hazenberg, 2011, p. 41). The nature of the settlement is militaristic with a strongly varied civilian settlement. The peripheral area therefore has a rural, not tightly planned character. The building on the northern plot also appears indigenous despite the deficient information. To an extent, this pluralistic composition of the population is reflected in the material remains on the vicus site. Both hunting and fishing had a minor part to play in the food supply at Matilo. Large game was scarcely consumed, despite the fact that excavations in the surrounding area revealed that large varieties of it were present (Hazenberg, 2011, p. 45; among others in Valkenburg)

Figure 8 Map of the research site and its surroundings in greater detail – Leiden (by R.L. Roelofsen-Menting).

4.2.1.1 Faunal remains

As described in the introduction to the Leiden Roomburg site, the finds collected during the excavations of Leiden Roomburg have not been studied much, if at all. There is, however, a small mention on the faunal assemblage in chapter four of the Leiden Roomburg research report, a summary is given below (Hazenberg, 2011, p. 45). Various animals were kept in the vicus of Leiden Roomburg, including cattle, pigs, sheep, goats and chickens. The age structure of the cattle bone material that was examined indicates a predominantly adult population. Cattle was consequently not kept primarily for meat production. The cows were maintained for milk and oxen were utilised as draught animals. The surplus of young bulls was slaughtered at the most economically favourable age for consumption. The waste of cattle bones in the vicus is the majority by far. In contrast, pigs were kept purely for slaughter. However, pig rearing was of small scale, due to the lack of suitable forest vegetation in the Matilo area; as a matter of fact, in the case of the pig bones, the meaty parts are far predominant, indicating that pork was brought in from other places. In contrast, sheep meat was exported from Matilo, as it is precisely from this species that the meaty parts are found in smaller quantities. While many sheep were slaughtered at a young age, a large portion was kept alive into their third year to harvest wool twice. Butchering sheep at their third year still yielded tender meat. The cultivation of sheep, however, was threatened by the presence of the liver bone snail, a parasite that thrives in a humid environment and is harmful to sheep. Finally, chickens provided eggs as well as meat.

Hunting and fishing played a minor role in the food supply in Matilo. Large game was scarcely consumed, although excavations in the area have shown that it was present in great variety. Of some importance to the menu are a few bird species such as the heron, the lapwing, the golden plover and the goose. The goose, however, was probably bred rather than shot. Indeed, geese can serve both for consumption and surveillance. Some songbirds, on the other hand, which were regarded as delicacies, were possibly imported. Fishing took place primarily in the fresh waters of the Rhine and the canal. Two fish hooks, net-weights and a fining needle, which ended up in the Corbulo Canal, confirm this. Amongst the sparse freshwater fish remains, carp are vastly in the majority. There is no mention of intensive sea fishing. It is striking that all the ingredients for the typical Roman fish sauce, namely sardine, anchovy and Spanish mackerel, are missing from the find material. Especially in the peripheral zone of the vicus, waste from oyster meals was found (Hazenberg, 2011, p. 44-46).

Due to the fact that the site has not been examined further on the faunal assemblage, it provided an excellent opportunity to incorporate this collection into this research and examine the bones for myself to use them as a primary data source. Furthermore, since the number of dog bones is high, a better synthesis regarding these individuals can be produced. The number of elements excavated within the Leiden Roomburg excavation results at 43.

4.2.2 Alphen aan den Rijn

The research area of Alphen aan den Rijn is located on the map sheet 31C of the topographic map of the Netherlands, scale 1:25.000 and the coordinates 105.300/460.400.

In 1998, the municipality of Alphen aan den Rijn started a major restructuring of the city centre on the left bank of the Oude Rijn River, the so-called 'Hoge Zijde'. A new town hall, a shopping centre, a theatre and cinema were to be built at this location. These buildings would require deep basements to create sufficient parking space. This would have destroyed all traces of Alphen's history existing in the soil. The municipal government therefore had an evaluation made of the archaeological values in the city centre (Kok, 1999; Polak, 2004, p. 15-16).

In the early Roman period, the landscape in and around Alphen consisted of a relatively active Rhine system with hardwood forest on the high banks of the central river system and softwood forest on the lower areas along the Rhine, with flood channels and remnant channels alongside which vegetation of reeds would have grown. The former branch of the Rhine would have been partially exposed and partially overgrown with aquatic and marsh plants. At high tide, the dead arm would have filled up with water. On either side of the meander belt were extensive swamp woods (alders), among which were swamp oaks. Areas of sedge, bordered by moorland, were further away from the Rhine. Streams such as the Aar, the Gouwe and the Meije drained the peat into the Rhine. During high water, the peat streams acted as supply channels (Polak, 2004, p. 34). It is unknown on what basis the Romans constructed the Alphen fort at this particular location. Presumably, the river bank to the north proved too narrow for a fort of this size and the residual river bed at this location formed a natural barrier to the northern part of the circulation canal (Polak, 2004, p. 35-36).

Figure 9 Map of the research site and its surroundings in greater detail – Alphen aan den Rijn (by R.L. Roelofsen-Menting).

4.2.2.1 Faunal remains

The bone material from Alphen aan den Rijn was not prioritised upon further reporting of the find material by the specialists. It consisted out of hundreds of kilos of bone, which meant that approximately one quarter of the total number of find groups contained bone. A selection of the bone finds from the barracks and the riverbank zone was made available to the University of Amsterdam for analysis as part of individual material practices. Only very general results could be reported in the report of the excavations (Polak, 2004). The studied animal remains originated from two spatially separated parts of the excavation, and the zooarchaeological investigation identified some evident differences in deposition and composition. The number of elements excavated within the Alphen aan den Rijn excavation results at 1 (Table 8) and the minimum number of individuals (MNI) is 1 in total. The results were lower than expected, due to the fact that a large amount of the bone was later on found to be dating in the early medieval period. These bone materials have therefore been omitted in the research, as it would have given a false overview.

4.2.3 Spijkernisse

An archaeological dig was initiated in 1985 by the Bureau of Antiquities of Rotterdam Municipal Authorities (BOOR; Bureau Oudheidkundig Onderzoek van Gemeentewerken Rotterdam). The research was required due to the presence of archaeology that became visible after non-archaeological excavation work. Two years later, the research was completed and both medieval and Roman levels were observed and excavated.

The research area was situated in between the ring polders Geervliet and Spijkenisse is the small polder Oud Markenburg, which presumably dates from the end of the 12th century. The Hartel West development area, in which the burial field was excavated, coincides with this polder, which is bordered on the south by the Groene Kruisweg road and on the north by the Haartelse Dijk, an inland dam dating from the year 1353. To the north of this area there is a 14th-century polder called Nieuw Markenburg. According to archaeological evidence, the channel system predates a Dunkirk I system, which was active from the Middle Iron Age to the Middle Ages (Döbken, 1992; Hallewas et al., 1979; Asmussen et al, 1990). The Roman level consisted of an indigenous-Roman burial field. The (partially) burnt remains of a dog were recovered from a burn site, which have been included in this research.

Figure 10 Map of the research site and its surroundings in greater detail – Spijkernisse (by R.L. Roelofsen-Menting).

4.2.3.1 Faunal remains

The faunal remains which have been included consists out of the elements, which are two separate individuals. It is believed that these individuals have been included in the grave as a grave offering (Döbken, 1992, p. 177). By means of grave site data collection and analysis, it is possible to gain insight into the settlement population's social structure. For the time being, the burial field of Spijkenisse lends itself only to a few global statements. The occupation pattern in this part was not of such nature that a strict hierarchy of settlements can be derived from it. When it was known, the settlements, including those in the wider vicinity of the burial field, consisted of single and scattered farms. Whether there were any differences between them is not known. Only a handful of sites have been excavated near Hartel West thus far. Some unusual finds, including metal vessels, suggest that the inhabitants, or at least some of them, did not fare badly in this area (Döbken, 1992). The number of elements

excavated within the Spijkernisse excavation results at 2 and the minimum number of individuals (MNI) is 2 in total.

4.2.4 Vlaardingen

The archaeological research at Hoogstad has been carried out between 1993 and 1997 by the Vlaardings Archaeological Office (VLAK). On two locations, excavations were carried out, coded with the numbers 5.019 and 6.036. The archaeological site included in this research is the location with the number 6.036 (Figure 11). The bone material on this location was primarily hand-collected. A small part, which came from sieved samples for botanical research, was not examined further (Dijk et al., 2009, p. 1)

Within the research, a creek filling was encountered dating from the Late Iron Age. It is intersected by a younger creek in which dams were also constructed, which shifted southwards in the course of occupation. Archaeobotanical and malacological (shells) investigations revealed that this was a freshwater tidal creek. Traces of farms or other settlements were not found. That habitation did take place around the dams is proven by the settlement waste found not only in the creek, but also in the ditches and depressions. The character of the find material makes it clear that this was an indigenous Roman settlement (Dijk et al., 2009, p. 3)

Two phases can be distinguished within the Indo-Roman find material. Phase 1 can be dated to between 70 and 125 AD on the basis of the imported pottery, while phase 2 can be dated between 120 and 175 AD, which was also on the basis of the imported pottery (Dijk et al., 2009, p 3). Most of the bone material was hand-collected (Dijk et al., 2009, p. 6).

Figure 11 Map of the research site and its surroundings in greater detail – Vlaardingen (by R.L. Roelofsen-Menting).

4.2.4.1 Faunal remains

The dog bone remains from phase 1 are from nearly all the parts of the body. It is only missing elements from the paw, although these phalanges and sesamoid bones are small and might have inadvertently been overlooked during hand collecting. With the help of the femurs, it is possible to conclude that the remains come from at least four dogs. They all reached at least one and a half years of age. In fact, a left and a right intact femur came from the same individual. Combined with eight other complete bones, these bones can be used to calculate shoulder heights. The range of their heights varies in length between 33 and 62 cm(Dijk et al., 2009, p. 13). Bite marks are evident on several of the mammal remains, some of which clearly indicate that the marks were caused by dogs (Dijk et al., 2009, p. 15)

The dog remains from Phase 2 stem from at least three individuals. While two dogs have attained an age of at least one and a half years, the third animal has not reached this age. Skeletal elements were present from every part of the body with the exception of elements from the foot. Using four intact bones, it is possible to ascertain shoulder heights ranging between 31 and 63 cm. Nearly 16% of the mammal bones found in this phase show chewing marks. In fact, they were found on all the distinguished species, including a bone fragment of dog (Dijk et al., 2009, p. 24)

The dogs' wide variation in size may indicate that the animals fulfilled a variety of tasks according to their size. While the larger dogs may have been used as guard dogs or herding dogs, the smaller animals may have been used as pest controllers and companion animals. Some of the dog bones exhibit processing marks that may have been created during the skinning of the carcass. The chewing marks on a small section of mammal bones were partly caused by dogs. Consequently, these bones must have been located on the surface in a place accessible to dogs or were fed to the them. A small section of the remains has traces of burning. These might have occurred during the preparation of meals or they are a result of waste burning. The bone material is relatively highly fragmented. On one hand, this is caused by preservation conditions. On the other hand, human actions, such as meat processing and meal preparation, also influence the degree of fragmentation. In this context, chewing, trampling and deterioration through prolonged exposure to air should also be mentioned (Dijk et al., 2009, p. 35)

4.2.5 Den Haag

The Archaeological Department of the Department of City Management of the Municipality of The Hague conducted an archaeological excavation project near the Scheveningseweg in The Hague, which took place from 1984 until the summer of 1987 (Figure 12) (Carmiggelt, 1998, p. 5).

Below the soil level of the Roman period, a partially ploughed soil level from the early Middle Ages was found. This layer was divided by a sand layer, underneath which a second culture layer was discovered. This bottom layer was similarly dated to the Roman period. Nonetheless, the differences between the two layers were considerable. The Roman period soil levels are referred to as layer I and layer II, respectively (Carmiggelt, 1998, p. 7). The lower level (layer I) yielded finds and traces of an indigenous Roman Canaanefaten settlement originating around the first half of the 2nd century AD. Layer II was characterised by a high abundance of finds. The occupation period according to the material collected can be estimated between 190 and 250 AD, with a possible brief revival around 270 AD. Layer I and layer II differ significantly from each other. Notable are the military finds from layer II. These include not only cloak pins, which distribution area does not extend beyond the Limes zone, but also types of armour, which are mainly found in army sites. In addition, fragments of weapons, equipment and armour were found (Carmiggelt, 1998, p. 7-9). Prior research conducted by J.H. Holwerda revealed that the same location also contained the traces of what was thought to be a small mile station (Carmiggelt, 1998; Waasdorp & Zee, 1988; Waasdorp, 1997). The resemblance between these two sites is so striking that a military settlement at Scheveningseweg is most probable. The fact that a military structure was not discovered there is thus not particularly surprising given the small size of the survey site. It is entirely conceivable that it is still in the subsurface.

The archaeological level was located at a considerable depth, which meant that the conservation conditions were better than usual for sandy soils. The bone material generally appeared to be in decent condition. For this reason, both the habitation layers and the soil traces underwent sieving. The outcome of this excavation strategy yielded a large number of bone remains, amongst other things. A large proportion of these were subjected to close examination. Due to the potentially exceptional character of the Roman settlement in particular, a thorough archaeozoological and botanical investigation based on as much data as possible was of interest. The results could in fact provide insight into the possibly military character of the settlement on the Scheveningseweg (Carmiggelt, 1998, p. 5-10).

Figure 12 Map of the research site and its surroundings in greater detail – Den Haag (by R.L. Roelofsen-Menting).

4.2.5.1 Faunal remains

The rigorous method of collecting during the dig at the Scheveningseweg has implications for archaeozoological research. This is because the quantitative and qualitative data cannot be easily compared with data from other sites where the collection took place (mainly) by hand. For instance, collecting bone material by sieving the soil not only impacts the species list (it greatly increases, since the remains of smaller animal species are also collected), but the percentages between species will also deviate significantly when compared to hand-collected material. In hand-collected material, for example, horse and cattle will be over-represented, due to the presence of unbroken and/or large bones, while sheep/goat are arguably under-represented. In this context, Lauwerier calculated the effectiveness of collecting by hand compared to the 'sieved' values (Van Wijngaarden-Bakker, 1988). It should be noted that these effectiveness values are not constant, as the soil type, the nature of the settlement and/or ground track, among others, also influence them. Nevertheless, the numbers do indicate in general terms the effectiveness of hand collecting with regard to the main domestic animals (Carmiggelt, 1998, p. 13-14).

There were dogs in both the indigenous and the Roman settlement. For the Roman settlement only, shoulder heights were able to be defined. One complete skeleton had a height of 31 cm (based on a femur, gl = 103). While a radius bone (gl = 80) and a tibia (gl = 93) yielded 27 and 28 cm, respectively, as shoulder heights for two dogs. Upon digging down during the dig from layer II to layer I, another radius bone (gl = 89 mm) and a tibia (gl = 233 mm) were found, which belonged to dogs with a shoulder height of 30 cm and 69 cm, respectively. A number of other dog bones from the Roman settlement (including shoulder blade fragments) seem to indicate that larger specimens occurred in addition to the small dogs previously mentioned (Carmiggelt, 1998, p. 26). Considering the small number of hunting animal bones, hunting in the indigenous and Roman settlement scarcely played a role (Carmiggelt, 1998, p. 27)

4.2.6 Tiel-Passewaaij

A large-scale archaeological excavation was carried out between 1992 and 2005 in Tiel-Passewaaij. The excavations were conducted by the amateur association BATO, the Rijksdienst voor Oudheidkundig Bodemonderzoek (the Dutch National Institute for Archaeological Research) and the Vrije Universiteit Amsterdam (VU University Amsterdam) (Groot, 2008a, p. 32)

The site of Passewaaij is a new residential area that is part of the city of Tiel. Located in the Eastern Netherlands River Region (Figure 7; Figure 13), Tiel-Passewaaij is situated within the borders of what used to be the Roman Empire. When it became apparent that Tiel-Passewaaij was the proposed location for a new residential area, the area was inspected for archaeological remains. During the survey, consisting of three sites, the settlement Oude Tielseweg, a second and larger settlement Passewaaijse Hogeweg, and a cemetery were found. The cemetery is situated between the two settlements. Together with a stream and moats, they constitute a complete settlement landscape (Groot, 2007 p 1-3). The Oude Tielseweg site represented a relatively small rural settlement, which probably contained only one farmhouse which was occupied at any time. This settlement was inhabited sometime during the Middle Iron Age, as well as from the Early to Late Roman period. As for the second settlement, Passewaaijse Hogeweg, it is approximately 300 metres from Oude Tielseweg. With two to four contemporary farmsteads, this settlement is larger than the Oude Tielseweg. Occupation layers dating from the Middle to Late Iron Age have been encountered. In addition to house plots, there were numerous ditches, small outbuildings, pits and wells discovered. These are all features that were typical of a rural settlement. The cemetery had been in use from approximately 60 until 270 AD (Aarts et al., 2007, p. 72; Groot, 2007, p. 3) Oude Tielseweg and Passewaaijse Hogeweg

are regarded as separate settlements. Identifying the boundaries of unenclosed rural settlements has proven to be difficult (Willems, 1981, p. 89; Groot, 2007, p. 3; Vossen 2003, p. 424).

The respective settlements, which comprise the following two: Oude Tielseweg and Passewaaijse Hogeweg, were analysed and reported independently. This decision was made due to the fact that the fieldwork was carried out separately and the methods for analysing the data differentiated (Groot, 2007, p. 3-4). Inhabitation of the site resumed from the Early Roman period. The settlement activity started at approximately 15 BC and continued until 170 AD. This time period is classified into three phases: 2, 3 and 4 (Groot, 2008a, p. 5)

At the site, the faunal remains are exemplarily as it is not only containing the remains of two complete settlements and a cemetery, but also comprises of a large assemblage. Such a large assemblage is possible due to the fact that the preservation of the animal bones ranges from good to excellent. This is thanks to the clay soil as well as the high-water table (Groot, 2008a).

Figure 13 Map of the research site and its surroundings in greater detail – Tiel Passewaaij (by R.L. Roelofsen-Menting).

4.2.6.1 Faunal remains

Throughout the excavations, considerable care has been taken to gather as many animal bones as possible by hand. In spite of the best efforts of the excavation crew, due to the nature of the clay soil, particularly during wet conditions, it was unavoidable that fragments were overlooked. While certain elements had been sieved, there was no methodical sieving in the settlements. High-potential features, rich in finds, were partially sieved. However, the volume of the sieved samples was not recorded, which limits the possibilities for statistical research. During the analysis of animal bones, the sieved and hand-collected samples were not separated (Groot, 2007, p. 26-27)

Across all phases, dogs represent a very small proportion of the total amount of fragments. The percentage fluctuated between 0.3 and 4.0, although it was usually between 1 and 2%. While the number of dogs was small, they nevertheless contributed significantly in the economy through important tasks. Within Tiel-Passewaaij, three different groups of dogs can be identified: little dogs with a shoulder height of approximately 30 cm, medium-sized dogs with a shoulder height measuring between 56-64 cm and large sized dogs with a shoulder height exceeding 70 cm. Medium-sized dogs were most commonly observed in Tiel-Passewaaij, reaching a total of eight individuals. There were two little dogs found and one large dog, with a shoulder height measuring 74 cm.

The majority of dog bones for which the shoulder height could be calculated, date from phases 3-6. As for the two individuals from phases 2 and 7, they were both mid-sized dogs. In phases 2 and 3, cut marks were found on dog bones in both settlements. Overall, no indications exist to suggest that dogs were eaten at one time in this area; the cut marks are most probably the result of skinning. The absence of cutting marks at later phases may be coincidence as a consequence of the very small number of total dog bones. Alternatively, however, it may indicate a shift in the perception of dogs through time. While higher percentages of dog were perceived to correlate with a high percentage of sheep for some phases in the Old Tielseweg, these differences do not appear to have been substantial. This also excluded a correlation between dogs and wildlife. Sheep herding and hunting may have not been the primary tasks of dogs (Groot, 2007, p. 60-61)

CHAPTER FIVE: METHODOLOGY

Included in this chapter are the methodological approaches, which have been applied in this paper. A proportion of the remains was studied directly; this dataset was complemented by metric data sourced from published literature.

5.1 Outline of methodology

This subchapter will outline each of the archaeozoological analytical techniques used in this paper, the research that underpins their application, and the advantages and limitations of each.

To carry out this investigation, the Roman dog remains originating from the aforementioned sites along the Limes of the Netherlands, were analysed in the Laboratory for Archaeozoological Studies of the Faculty of Archaeology of Leiden University. The determination was supervised by Dr. Laura Llorente Rodríguez and André Ramcharan. Various techniques were used during the examination of the skeletal material, which will be addressed throughout this chapter. All dog remains were quantified as Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) (Lyman, 2008).

In order to evaluate the tophonomical history of the dog deposits and, therefore, dog treatment after death, skeletal profiles were analysed per assemblage alongside, bone fragmentation and bone surface modifications such as anthropic (e.g., cutmarks, chop marks), biological (e.g., gnawing marks) or natural marks (e.g., weathering) (Lyman, 1994).

The evaluation of the mortality profiles of the individual dogs is an indication of the domestic practices that have influenced the treatment of these animals. Establishing such an age profile can provide a certain pattern in the mortality of the animals, which, in turn, can tell us what kind of use these animals had. Age and sex determination were recorded whenever possible following standard literature in archaeozoology (Habermehl & Habermehl, 1975; Horard-Herbin, 2020; I. A. Silver, 1969; Ruscillo, 2002, 2015).

To investigate morphology and the role of dogs, detailed morphometric and palaeopathological analyses were carried out, followed by an in-depth contextual framework of remains. Morphometric analysis can provide the basic information on the relative size of the dogs and give them a context that can categorize them along the lines of modern breeds or morphotypes. This can give a better understanding considering the possible function the dog could have had during its life. Whilst doing this, the bases of the relationship between the dog and the human population can be speculated, as certain types have unique roles within society. Subsequently, palaeopathology gives us a whole different angle toward the life of the dog and how it was treated. Was the dog allowed to live with a malfunction? Were some dogs treated during their lives, as their injuries or illnesses demanded

treatment? To what degree was this treatment applied? Or had the dog no right to live when not in full health? Lastly, the contextual circumstance is of great importance, as it can explain a great deal about the value of the animal during life. As the skeletal elements originate from excavations that have been conducted throughout a wide period, the accuracy of these details can vary. Nevertheless, the message this context conveys can contribute in any case.

For this, bone and teeth measurements were taken whenever possible with a digital Calliper (± 0.05 mm estimated error) following Driesch (1976). During archaeozoological studies, only in exceptional instances can complete skeletal remains be obtained. Therefore, a considerable effort has been invested in finding the most suitable methods, which result in the best possible description of skeletal remains. A very important feature in the reconstruction of the animal type is the shoulder height (Harcourt, 1974) or withers height. This has already been reported to be a key indicator in the interpretation of the variability of dogs and in the description of their physical appearance (Clark, 1995; Harcourt, 1974). Finally, when a pathology was detected, it was categorised attending to Baker & Brothwell (1980).

All information was recorded following the ROB-archaeozoological protocol (Lauwerier, 1988) using the Access database Bone developed by Eric Dullart.

In addition, archaeozoological and osteometric data of Roman Dutch dogs from the literature was recorded to build up a larger database with which to investigate the presence and morphology of these canids. Sites with presence of dog remains were retrieved from the digital Boneinfo V01_10 (RCE, 2021). Sites and data from the literature can be seen in appendix II. As previously described, this study combines several methodologies during this research.

5.2 Quantification

Two principal methods of recording the abundance of a species are the number of identified individuals (NISP) and the minimum number of individuals (MNI). The NISP is the total number of identified bones of a taxon species. However, as discussed by Klein & Cruz-Uribe (1984; Grieve, 2012, p. 32), the number may seem to be exaggerated due to the fact that some animal skeletons contain more parts than others, or the conservation is quite well, but there is much fragmentation. Compared to the NISP, the MNI takes into account the "sides" of the animals, e.g., two left femora equal two individuals. When complete skeletons are found, the MNI can put the number of fragments into context. Therefore, the

MNI will never exceed the total of the NISP count. It is invariably beneficial to register both numbers since they can provide a more accurate and realistic picture of the number of animals in an area. Wallis & Albarella (2004, p. 88) indicates that MNI becomes untrustworthy when implemented on very small assemblages. The MNI is only an approximate value for the number of individuals, overestimating minor taxa compared to NISP counts (Grieve, 2012, p. 111; O'Connor, 2000, p. 60).

5.3 Age estimations and age profiles

There are two techniques to determine the age of an individual, tooth eruption an epiphysial fusion. The eruption rate of teeth as measured in several domestic dog breeds (*Canis familiaris*) and the gray wolf (*Canis lupus lupus*) demonstrates a consistency of developmental rate. Limitations arise due to the fact that the majority of domestic dog breeds do not achieve tooth maturity until five months of age, which makes it impossible to provide estimations of ages beyond five months when only individual teeth are evaluated. Epiphyseal fusion, or the ossification of the joint ends of a bone, is much less reliable as a proxy for age estimation and as such should be employed wisely, since only a broad estimation of the age range may be provided. Yet, studying epiphyseal fusion has its merits as it allows overall hypotheses about the age of mortality of an individual, particularly as it enables age estimates beyond what is possible by examining tooth eruption on its own (Gene, 2018, p. 51-53).

Silver (1969) states the following about the ageing of dogs by epiphyseal fusion and tooth eruption (Table 1; Table 2). These ageing tables have been frequently referred to in animal bone reports, including within the literary studies added to this research. The fusion of the epiphyseal bone generally completes when the dog is 18 months old, whereby nutrition and hereditary factors influence the process. In addition, the degree of ossification depends on the type of dog and gender. Hufthammer (1994) suggested that dogs in early medieval times, with irregular and poor nutrition, may have taken longer to reach maturity. However, indicating that the sequence of fusion would have been similar. This is a comment that may also be present in dogs from the Roman period.

Table 1 post-cranial age criteria for dogs from Silver (1969, p. 285-286).

Elements	**Epiphyseal union in months**	
	Ossification centre	Closing
Scapula	Bicipital tuberosity	6-7 months
Humerus	Proximal epiphysis Distal epiphysis	15 months 8-9months

Radius	Proximal epiphysis Distal epiphysis	11-12 months 11-12 months
Ulna	Olecranon Distal epiphysis	9-10 months 11-12 months
Metacarpus	Proximal epiphysis Distal epiphysis	Before birth 8 months
1st Phalanx	Proximal epiphysis Distal epiphysis	7 months Before birth
2nd Phalanx	Proximal epiphysis Distal epiphysis	7 months Before birth
Femur	Proximal epiphysis Distal epiphysis	1 ½ years 1 ½ years
Tibia	Proximal epiphysis Distal epiphysis	1 ½ years 13-16 months
Fibula	Proximal epiphysis Distal epiphysis	15-18 months 15 months
Metatarsus	Proximal epiphysis Distal epiphysis	Before birth 10 months

Table 2 Age criteria for dogtooth eruption from Silver (1969, p. 299).

Teeth	**Tooth eruption**	
	Deciduous	Permanent
Incisor 1-3	4-6 weeks	3-5 months
Canine	3-5 weeks	5-7 months
Premolar 1	Absent	4-5 months
Premolar 2-4	5-8 weeks	5-6 months
Molar 1		4-5 months
Molar 2		5-6 months
Molar 3		6-7 months

Horard-Herbin (1998) has established a wear pattern based on several research projects. The pattern defines seven stages (Figure 14; Figure 15). They are divided into A, B, C, D, E, F and G (Figure 14; Table 3). According to Horard-Herbin, the stages are categorised according to the criteria below:

A: The first molar is new and fully erupted (a) or starts to wear but without exposed dentine (b);

B: (a) Slight wear can be determined, with exposed dentin on the protoconid, (b) the metaconid, (c) or at the junction between the paraconid and the protoconid;

C: at this stage, two isles of wear are apparent, with a distinction being made between five variants of this, namely: (a) on the protoconid and the metaconid, (b) on the metaconid and the hypoconid, (c) on the protoconid and the hypoconid (d) on the protoconid and the entoconid and lastly (e) on the junction between the paraconid and the protoconid and the protoconid;

D: For this stage, the dentin becomes evident systematically at the junction area between the paraconid and the protoconid with additionally (a) the metaconid and the hypoconid, (b) the protoconid and the metaconid, (c) the protoconid, the metaconid, and the hypoconid, or (d) the protoconid, the entoconid, and the hypoconid;

E: This wear stage corresponds to a new amplification of wear to the junction area between the paraconid and the protoconid, but also between the protoconid, which remains separate. In addition, wear is also visible on (a) the metaconid, (b) the hypoconid, (c) the metaconid and the hypoconid, or (d) on the entoconid and the hypoconid;

F: At stage F, the dentin of the paraconid and the protoconid combine to form one, while the abrasion continues at the following parts: (a) At the metaconid and the entoconid, (b) at the metaconid and the hypoconid, (c) at the metaconid, the entoconid and the hypoconid;

G: This last stage shows intense wear, with the occlusal surface phase becoming flat. (a) The plane of wear between the paraconid and protoconid is large, (b) Crown high is reduced by a third. At (c) the paraconid and protoconid have become one wear plane and, at (d), the wear plane is large enough to merge the protoconid and metaconid. In this process, the tooth is worn by two-thirds.

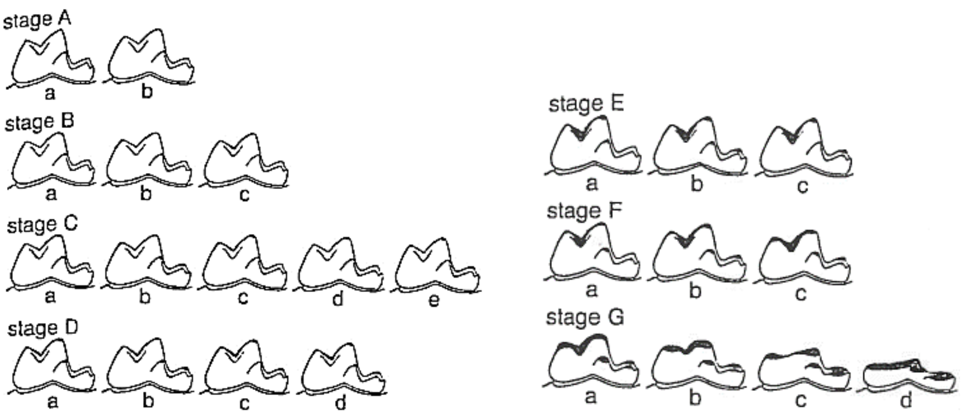


Figure 14 Dental wear sequence of dogs. Lingual view provided of right permanent first molar. Abrasion facets have been shaded black (Horard-Herbin, 1998).

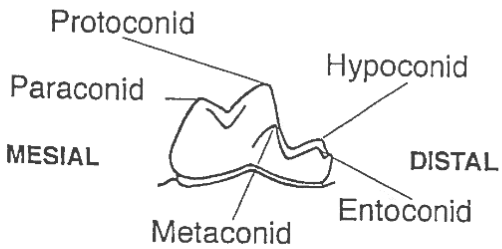


Figure 15 Nomenclature of the trigonid and the talonid of the lower permanent first molar (Horard-Herbin, 1998).

Table 3 The relation of tooth wear stages as described by Horard-Herbin (1998).

Age in months	6-10	10-15	15-24	24-36	36-48	48-72	**>72**
Stage A	46%		12%				
Stage B	23%		16%				
Stage C	31%		20%	17%			
Stage D			48%	17%			
Stage E			4%	67%	25%		
Stage F					75%		
Stage G						100%	100%

A total of two mortality profiles are established and have been recognized by palaeontologists (Bailey, 1983; Kurtén, 1953; Lyman, 1994, p. 126). Archaeologists have added, in addition to these two fundamental or baseline mortality profiles, six or seven other profiles. One basic mortality profile is generally called the "normal" mortality. It is modelled as an age profile in which very young and very old individuals are over-represented relative to their over-represented relative to their living abundances, and reproductively active adults are under-represented as a result of varying mortality rates across the age classes (Graig & Oertel, 1966, p. 351). Age profiles typically look two-mode, with one mode on the far left and the other to the right of centre. This type of profile is often referred to as "U-shaped" (e.g., Klein 1982b, p. 50-54). Natural mortality is the outcome of normal or routine ecological-related deaths of population members (Lyman, 1994, p. 126-127). Assuming that mortality is gradual, it reflects the circulation rate of biomass in a community and presents "a balanced representation of a fauna as it naturally existed" throughout time (Voorhies 1969, p. 23).

The second basic mortality type, commonly known as a "catastrophic" or "mass" mortality pattern, is modelled as an age profile in that successively older age classes tend to be represented by increasingly fewer individuals (Lyman, 1994). Age profiles appear as unimodal curves with extreme positive skewness. Such a profile is frequently referred to as "L-shaped" (Klein, 1982, p. 53). Mass mortality produces a synchronous, nonselective "snapshot" (Voorhies, 1969) of the age structure of a population at the time of death. Theoretically, mass or catastrophic mortality should result in the death of higher relative frequencies of reproductively active adults. (Voorhies, 1969, p. 46-47). Natural catastrophic mortalities include floods, droughts and volcanic eruptions. Similar conditions may be encountered in jump sites and traps in which large numbers of animals were killed simultaneously (Bailey, 1983).

There are, however, several difficulties with age profiles. An instantaneous event that causes the synchronous death of all members of a population in fact generates an age profile of those individuals who have survived the normal mortality (Klein, 1982, p. 58). Consequently, as Graig & Oertel (1966, p. 351) observe, "the perfect population with mass mortality is a 'frozen' living population. population." Thus, in a sense, the age profiles that are imaged as the two different profiles could come from the same population of animals. In fact, mortality over time for a population must be of the natural type for the surviving population to exhibit an L-shaped (or catastrophic) demographic structure (Lyman, 1994, p. 127).

5.4 Size estimations

Using morphometric analysis on the fanaul assemblages provides information on the relative size of the dogs that have been found. This information can give an overview of the size variation within one site and between the sides. By assessing the size of an individual, it can give an indication on the relation to size and treatment of individuals. The information derivable from morphometric data includes development of relative indices, possible live weight and estimates of shoulder height (Gene, 2018, p. 54; Anyonge 1993; Clark 1995; Clark 1997a; 1997b; Forest 1997; Harcourt, 1974; Wroe et al., 1999) In order to perform measurements for the bone elements, regarding the size estimations, all possible measurements were carried out, according to those presented by Driesch (1976). All these will be listed in the appendix for the purpose of potential further research.

5.4.1 Body mass

The body mass represents an essential biometric quantity which is useful in interpreting many of the aspects of an animal's life history (Losey et al., 2014, p. 180). The morphological appearance of animals can be acquired through the calculation of body mass (BM). Losey and colleagues' population sample, for the purpose of estimating body mass, of 47 dogs of various breeds including four juvenile dogs. They presented the regression formulae both with and without juveniles since the small sample of young dogs "may have biased their results in unrecognisable ways" (Losey et al., 2017). However, they also observe the fact that the use of a single breed and sex would presumably produce the more accurate formulas. While recognising size diversity in modern breeds, it was considered that data derived from the Losey et al. (2017) study on modern canids provides the closest proxy currently available for estimating the body mass for carnivores, with a general margin of error of less than 10% (Carder et al., 2023; R. Losey et al., 2014), and is therefore implemented in this study.

In their study, Losey et al. (2014) employed cranial and mandibular measurements, which made use of the VDD's measuring method, i.e. Von den Driesch (1976), that concluded in statistics for linear regression equations to subtract an estimation on the body mass. Losey subsequently extended his research thereafter on linear regression equations that included the use of long bone dimensions (Losey et al., 2017). The raw measurement (R) mentioned in the formulae below is the measurement taken by utilizing the method described by (Von den Driesch, 1976). In Table 4 and Table 5 an overview from Losey et al. (2014; 2017) of the statistics of linear regression equations are displayed. In order to utilise Losey's body mass formula, it is necessary to enter information for the coefficient and the constant.

$$\underline{\text{Body mass}}\ (kg) = 10\text{^}log(y)$$

$$log(y) = \alpha + \beta * log(x)$$

$$\alpha = constant;\ \beta = coefficient$$

$$log(x) = log10(R)$$

For example, for a fictional dog, I estimated its body mass using the VDDm18 wolf-dog (table 4) mandibular regression equation. The raw measurement of this dimension on the dog mandible is 45 mm, which can be entered into Microsoft Excel and then log10 transformed using the '=log10(45)' function, producing a result of 1.653. This number is then multiplied by the coefficient value of 2.301. The constant value, in this case a minus (Table 4); 2.738, is then subtracted from this result, which rendered a value of 1.0660. The inverse log of this number is then obtained using Excel function '=10^1.0660', producing an estimated body mass value of 11.64 kg.

Table 4 Statistics for linear regression equations between *Canis* spp. (combined wolf and dog dataset) cranium dimensions and body mass. VDD is Von den Driesch (1976), and Morey is Morey (1992) (Table 5 from R. Losey et al., 2014).

Dimension	**Coefficient**	**Constant**
Cranial		
VDDc1	2.704	−4.919
VDDc2	2.849	−5.177
VDDc3	2.837	−5.075
VDDc7	2.998	−4.629
VDDc8	2.275	−3.216
VDDc9	2.444	−3.723
VDDc13a	2.869	−4.416
VDDc15	2.379	−3.017
VDDc16	2.528	−1.852
VDDc17	1.687	−1.502
VDDc18 length	2.269	−1.596
VDDc18 breadth	1.218	+0.164
VDDc20 length	1.144	+0.160
VDDc20 breadth	1.297	−0.138
VDDc29	2.751	−3.418
VDDc30	2.918	−4.639
VDDc34	3.804	−5.677
Morey OI	2.280	−3.101
IM2	0.389	+0.715
P3 length	2.101	−0.957
Mandibular		
VDDm1	2.840	−4.859
VDDm2	2.710	−4.570
VDDm3	2.815	−4.750
VDDm4	2.607	−4.174
VDDm5	2.586	−4.075
VDDm6	2.484	−3.917
VDDm7	2.600	−3.658
VDDm8	2.695	−3.782
VDDm9	2.444	−3.206
VDDm11	2.487	−2.707
VDDm12	2.590	−2.726
VDDm13 length	2.218	−1.659
VDDm13 breadth	2.373	−0.944
VDDm14	2.113	−1.495
VDDm15 length	1.008	+0.475
VDDm15 breadth	0.939	+0.663
VDDm17	2.588	−1.412
VDDm18	2.301	−2.738
VDDm19	2.406	−2.020
VDDm20	2.538	−2.000

Table 5 Statistics for linear regression equations for dog limb dimensions and body mass, adult, and juvenile individuals combined (table 1 from Losey et al., 2017).

Dimension	Coefficent	Constant
Scapula		
LG	2.438	−5.339
BG	2.769	−5.151
SLC	2.339	−4.610
HS	2.663	−10.217
Humerus		
BP	2.401	−5.353
DP	2.645	−6.882
BD	2.547	−6.016
BT	2.564	−5.437
GL	2.339	−8.840
Radius		
BP	2.665	−4.831
DP	2.444	−3.149
BD	2.630	−5.528
DD	1.860	−1.909
GL	2.102	−7.577
Ulna		
LO	1.577	−2.327
DPA	2.351	−4.704
BPC	2.118	−3.134
GL	2.029	−7.571
Femur		
Hbr	2.631	−4.774
Hdp	2.563	−4.577
BP	2.607	−6.608
BD	2.634	−6.221
DD	2.320	−5.282
GL	2.327	−8.975
Tibia		
BP	2.740	−6.909
DP	2.667	−6.646
BD	2.775	−5.889
DD	2.720	−4.791
GL	2.038	−7.475

5.4.2 Shoulder height

Multiplying factors used for estimating shoulder heights out of the total length of long bones were devised by Koudelka (1885) (Harcourt, 1974; Müller, 1967). The shoulder height (Figure 16), among all size estimation techniques, is the most applicable to express the visual characteristics of dogs and to evaluate size variation (Daza-Perea, 2017) and the most used size estimation in Dutch research papers. To derive reliable shoulder height estimates, it is possible to examine long bone length (Harcourt, 1974), metapodia length (Clark 1995) and cranial measurements (Chrószcz et al., 2007; Gene, 2018, p. 55). One issue concerning use of shoulder height, as described by Harcourt (1974, p. 171), involves the use of a dog's size to determine his or her role. He finds the correlation between animal size and role is questionable and this will, therefore, be taking in consideration.

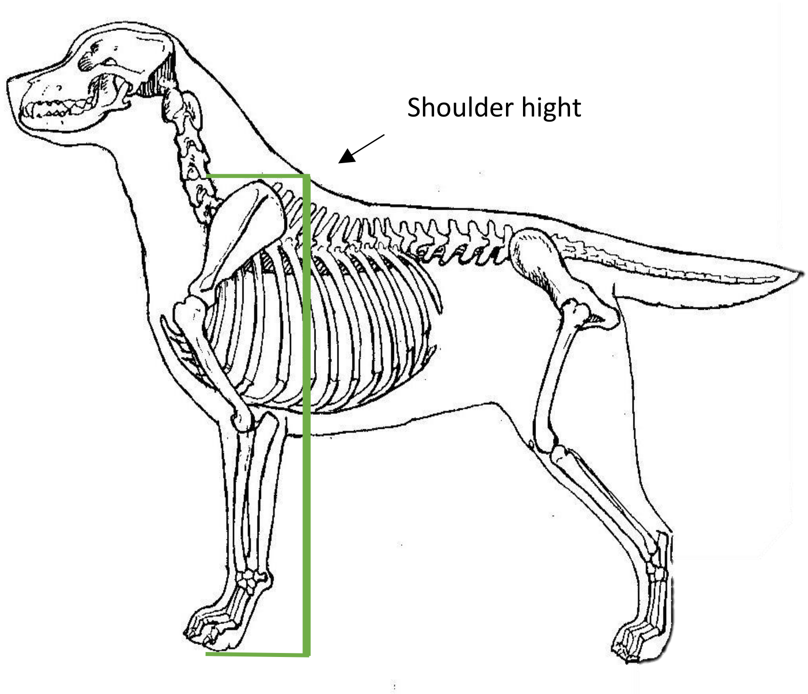


Figure 16. Customary sites for measurement of body height. Illustration after the image from M. Schlehr (Zink & Schlehr, 2020) and modified by R.L. Roelofsen-Menting.

5.5 Skull and mandible measurements

Traditionally, specific measurements are taken on the skull. All of which were taken in the present study. Regrettably, many of these measurements concern features hidden under thick muscle or otherwise invisible in the living animal. For this reason, Harcourt (1974) devised a system that emphasized the tangible identifiers which lend the skull its shape. In his research, "the dog in prehistoric and early historic Britain," he initially made 12 measurements. However, some of them contributed little or nothing. The system is shown below (Figure 17) and each measurement is marked with a Roman numeral to avoid confusion with the actual measurements. The system of Harcourt is combined with the work of Driesch (1976, p. 42-45).

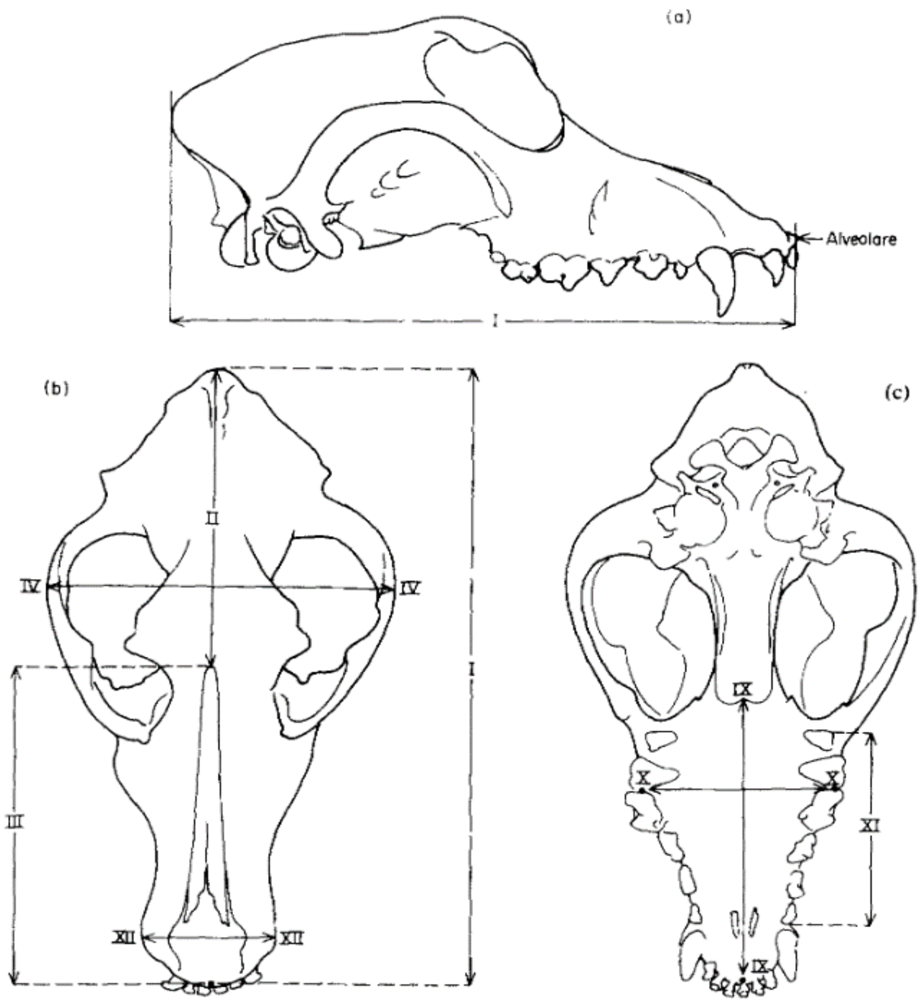


Figure 17. How the skull measurements have been taken. (a) Lateral view of a dog's skull; measurement I. (b) Dorsal view of a dog's skull; measurement I, II, III, IV and XII. (c) Ventral view of a dogs skull; measurments IX, X and XI (Harcourt, 1974).

The measurement data of the skull gives information on the size of the head, a useful method of assessing the size of the dog. In his research, Harcourt (1974) states that there are three head features that can contribute a contribution to the knowledge that can be gained from head measurements, namely: The Cephalic index, the Snout index and the Snout with index, which will be discussed in the following subchapters. The Cephalic Index considers the width of the cranium compared to its length. The snout index takes into account the length of the snout with respect to that of the whole head. The snout width index examines the width of the snout compared to the length of the nose.

5.5.1 Cephalic index

The Cephalic Index represents the ratio of the width of the skull to the overall length, as featured on Figure 18. In order to calculate this index, the following formula has been applied:

Zygomatic width (C30) x (100/Total length (C1)) (Grieve, 2012).

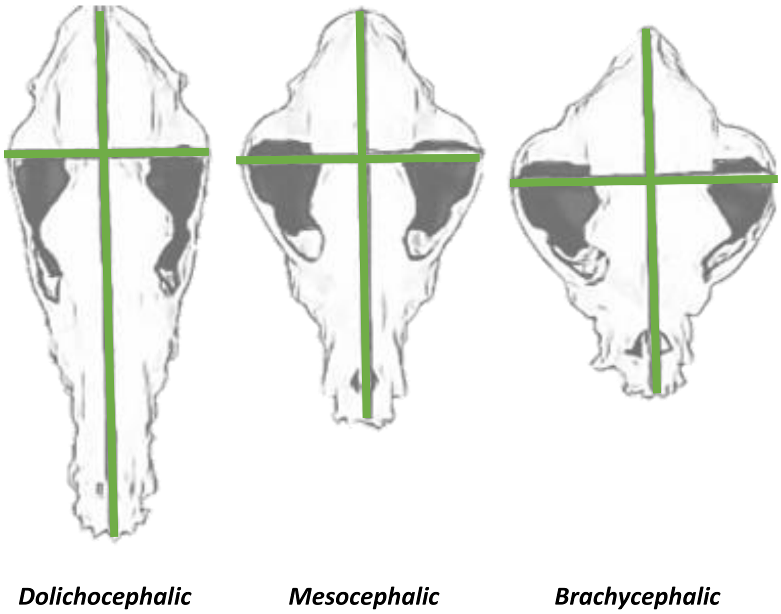


Figure 18 The variation in head shapes or the Cephalic index (Coren, 2023) and modified by R.L. Roelofsen-Menting.

5.5.2 Snout Index

The Snout Index compares the greatest length of the skull to the width of the snout, a very distinctive and highly variable features of a dog's facial appearance (Grieve, 2012, p. 77). In order to calculate this index, the following formula will be applied:

Viscerocranium length (C8) x (100/Total length (C1)) (Grieve, 2012).

5.5.3 Snout width Index

Snout width index compares the length of the snout to its width, with the following calculation:

Width at the canine alveoli (C36) x (100/ Viscerocranium length (C8)) (Grieve, 2012).

5.6 Sex determination

Establishing the sex of a dog skeleton is challenging due to the mostly absent sexually dimorphic features on their bones, particularly due to the extent of variation in their morphology and size. However, the easiest method to determine sex is simply the presence or absence of the os penis bone or baculum. Regrettably, owing to the preservation factors of the skeletal material, this bone is rarely present or, as with the paw bones, is easily missed by excavators.

Several methods have been developed to determine sex from the skull. Indeed, the skull shape shows some sexually dimorphic characteristics, but was not applied in this study due to the fact that this method has been found to be quite unreliable (Handley 2000, p. 15-205; Trouth 1976, p. 71-565).

Crockford (2000) noted that male dogs are generally 2% to 6% larger and more robust than bitches. This method was examined by west and noted that sexual dimorphism is normally more pronounced in smaller dog breeds than in large ones, but it was found not to be a reliable method when used alone and was therefore also excluded in this study.

In 2006, however, Ruscillo (2006, p. 62) developed a new technique using the humeri to identify the sex of a dog, known as the table test. This method requires the right or left humerus, which has to be complete, fully fused and without pathology. In the table test, one holds the humerus at its proximal end and places it on the surface of the anteroventral plane on a flat surface. When dropped on its medial side, the humerus is most probably male, whereas if it remains on the anteroventral plane, it is more likely to be female. The test, carried out on known samples, gave a probability of male sex of 85% and female of 70% when no other information on sex determination was available. For the self-examined section of the study, this method was used. This methodology was not cited in the reports leading to the conclusion that it had possibly not been used.

5.7 Burial Location

The location in which a dog has been buried or deposited can be relevant as a way of understanding the dog's relationship and the role it was given in its life. It is important to note, however, that the location and manner in which a dog is buried may not always reflect the role or relationship the dog had during the respective periods of its life. Considering this, it is feasible to consider both the individual burial site and the character of the location. This includes considering whether the site was military or civilian in character. Such data can provide a view of the dog's burial location and what it may entail, but definite conclusions cannot, in my opinion, be derived from this**.**

5.8 Butchery

The most common forms of anthropogenic manipulation of bone that are macroscopically observable are those of cut marks and fracture patterns (Gene, 2018, p. 60). In terms of cut mark morphology, there are three discernible activities which can be observed at low magnification, namely scraping, chopping and cutting. Since this study did not include macroscopic analysis, these three morphological markers are included. Chopping marks are caused by striking a bone surface with a tool at a perpendicular angle, creating cross sections that are distinctively V-shaped and exhibit bone particles that are pressed inward toward the bottom of the deepest groove (Gene, 2018, p. 60). Scrap marks result from perpendicular dragging of an edge of an artifact past the longitudinal axis of a bone, creating multiple fine striations in parallel directions over a much wider area than what is seen during slicing. These marks are often wider than slicing marks, which are arguably finer and show more parallel striations (Potts & Shipman, 1981, p. 80-577). The location of cutting marks is significant for the butchery methods employed. Cut marks that are associated with the skinning of smaller animals are observed surrounding the metapodials (Lebreton et al., 2017, p. 8-53).

Cut marks are the some of the more distinguishable markings that can be attributed to human activity and are commonly identified as being associated with the epiphyseal articulation areas. Cut marks on long bones usually follow the pattern that they are associated with articulatory centres; femurs may display markings in the area of the distal epiphysis, whereas tibiae and humeri may exhibit markings on either the proximal and distal epiphyses on the anterior and posterior sides (Binford, 1981, p. 107; Lyman, 1987). The cuts for filleting represent secondary butchery activity and are oriented largely along the longitudinal axis of the bone, alternatively occasionally taking the shape of shorter cuts on the underside of the bone to cut through muscle attachments in order to remove meat from the bone. Such marking occurs at greater distances from the epiphyseal joint points (Binford, 1981; Gene, 2018, p. 60)

The butchers' markings, will be described when they are known, but due to missing data provided in the research papers that were utilized, cannot provide adequate insight into the entire study. There will, however, be a review to determine what we can discern regarding the possible use of the dogs after their death with the data from the butchers' markings as well as their burial sites. If anything, the presence of butchery markings could show that dog meat was eaten. This would be the most forward possibility indeed, since dog meat is completely edible and contains the same amount of protein as pork, and in some countries, people raise dogs in order to obtain food (Simoon, 1994, p. 201).

5.9 Care

When evaluating the care and well-being of dogs, there are certain aspects to be considered. Before being able to assess the relevant data, it is essential to first consider the terminology used and how we view, characterise and subsequently evaluate it according to the data given in this study. To begin by considering the concept i.e., terminology of 'care'. A term that can mean many things and which is clearly culturally determined. As not all cultures, regions, periods, as well as individuals, attach the same meaning to this term, the determination of whether something is 'caring' behaviour, and by doing so has a caring relationship, becomes uncertain. Moreover, the ideological, psychological, moral, ritual and social foundations underlying such acts can be complex and are not simple to construe on the basis of archaeological data, regardless of the degree to which this might be augmented by input from other fields of research (MacKinnon, 2010, p. 292). For instance, as described by MacKinnon

(2010), in which the association of burials with dogs and humans in Greek and Roman antiquity (Day, 1984; De Grossi Mazzorin and Tagliacozzo, 1997; Lepetz, 1996; Soren, 1999; Trantalidou, 2006, list from MacKinnon, 2010, p. 292) can be considered an act of 'care', providing the deceased with a companion, protector or any other perceived role in the accompanying dog. Canine offerings can be designated as a similar situation in the case of this adherence to the term 'caring'. Hence, the term 'care' will be reduced here to include examples of the physical health and well-being of dogs, as observed from the available zooarchaeological database, for the purposes of the review (Grieve, 2012, p. 14; MacKinnon, 2010, p. 292-293).

A second point of consideration, as also noted in the study of MacKinnon (2010) can be found in the nature of the osteological evidence itself. When reviewing the data based on bones, osteologists are confined to all features that might leave marks on the skeleton. Indeed, a great number of diseases and pathogens do not tend to leave markings, while in these cases 'care' is very much possible (Siegel, 1976). In many instances, moreover, the signs are only visible on the bones themselves at an advanced stage of disease or stress, in which case the dog has reached an older age. Mild cases of disease, or death of the individual at a younger age, may have no noticeable effects on the skeleton. Typically, a bias then exists in mature, older dogs. In addition, puppies are considered to be important to certain Roman cultures, especially as offerings in infant and child graves (Soren 1999). Evaluating the health and welfare of puppies is possible (MacKinnon, 2010, p. 293), albeit highly unreliably. Namely, the resulting impression is not an accurate reflection of reality.

CHAPTER SIX: RESULTS

Similarly, to the animal bone reports that were read for this study, there were difficulties with the amount of detailed data that was provided in the excavation reports of the material that was included. Many of the specialists tend to centre their attention, as previously mentioned, on meat-bearing species rather than smaller mammals and birds. Numerous excavation reports omitted information on the completeness of the dogs, as well as the dogs' age, metric data or if they showed indications of butchery or pathology, despite the fact that there was often a small piece written about them with regard to shoulder height.

6.1 Quantification

The total number of dog remains analysed for this thesis amounts to 162 (NISP) and 97 individuals (MNI) (Table 6). By counting the elements, thereby distinguishing left (SIN) and right (DEX), an MNI estimation was calculated to be 97 individuals. However, some have been referred to in the literature of the reports, in response to their own database and examination of the bone material. In this regard, a number was listed in the final excavation report, from which this research will assume as the minimum number of individuals. As a result, the number from Vlaardingen is 9 individuals, 17 individuals for Tiel-Passewaaij and 5 individuals form The Hague. Incorporating the information in the reports, the minimum number of individuals in total is therefore 59, when taken the MNI and the reported count of individuals.

Due to collection bias, smaller elements such as metatarsals, metacarpals and phalanges did not contribute to these numbers or to the calculation of the number of individuals present. Unfortunately, only one skull has been examined during this research (Figure 19), the other skulls were analysed though literature research.

Table 6 The total individuals, represented in MNI, NISP of the sites (4.2 Site locations and excavation history; by R.L. Roelofsen-Menting).

Site	**Number of Identified Specimens (NISP[2])**	**Minimum number of individuals (MNI[3])**	**Literature information**
Vlaardingen	63	37	In the excavation report is the MNI of 9 mentioned. How this is established is not known (Dijk et al., 2009).
Tiel-Passewaaij	48	29	In the excavation report 17 individuals have been mention to have been found in a Special ditch (SD) (Groot, 2008).
Spijkernisse	2	2	(Döbken, 1992)
Leiden Roomburg	43	25	(Hazenberg, 2011)
Den haag	5	3	The shoulder height was measured per element, allowing a statement to be made about the number of individuals. in this case, five individuals (Carmiggelt, 1998).
Alphen aan de rijn	1	1	
Total	162	**97**	Incorporating the information in the reports, as mentioned above. The minimum number of individuals in total is therefore 59, when taken the MNI and the reported count of individuals.

[2] The NISP represents the most basic quantitative number recorded in an osteological collection. It counts the number of skeletal elements identified by both bone type and taxon (Lyman, 1994).

[3] The fewest possible number of animals in a skeletal assemblage (Klein & Cruz-Uribe, 1984, p. 26).

The elements, implemented in the thesis (Table 6), consist of 162 in total. The main categories comprise femur, humerus, radius and tibia elements. Out of the total number of elements which were implemented in the study, 65 have been self-analysed i.e., self-measured (Figure 19).

The data on Vlaardingen individuals is taken from the utilisation of the MNI method, but, differing from conventional, based on the number of mandibles. In the case of Spijkernisse, the data was mainly based on the location in which the skeletal remains were found. Since the assemblage was primarily found together, this enabled a fairly correct number of individuals to be reported. Furthermore, the researcher made use of the shoulder height differences to differentiate the dogs from each other at Den Haag, which allowed a firm ground to argue for five separate individuals. Figure 15 provides an overview of the elements from the dogs of the entire research. As previously described, a distinction has been made with regard to this table between non-applicable (NA); DEX or right; SIN or left. Since the measurements of the smaller elemental groups were redundant to display in a graph, tables have been created to present this data. The data from this site contribute little to the results of this subchapter, rather they are of particular interest to other parts of the results (chapter 6.7 and 6.9).

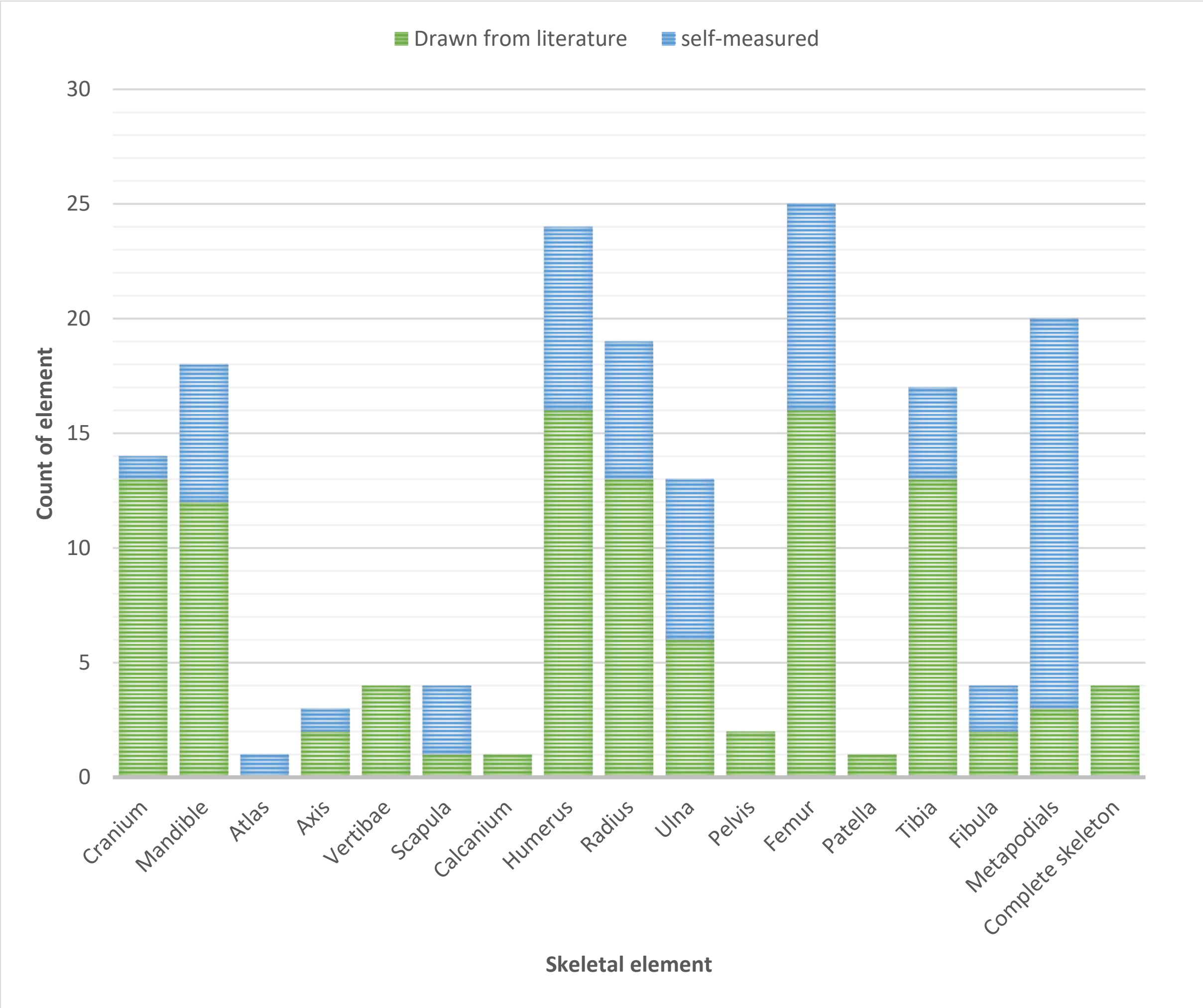


Figure 19 Total count of elements from my own analysis, divided into my own measurements and those taken from pre-existing reports (by R.L. Roelofsen-Menting).

Table 7 The element of Alphen aan den rijn (by R.L. Roelofsen-Menting).

Skeletal element		**Total**	**Marks**	**Measurement[4] (mm)**
Ulna right		1	NA	GL= NA SDO= 23,3 DPA= 27,5

4 According the guidelines by von den Driesch (1976).

Table 8 The elements of Spijkernisse and Table 9 The elements of Den haag (by R.L. Roelofsen-Menting).

Element	Amount
Humerus	1
Mandible	1
Total	**2**

Element	Amount
Tibia	2
Fibula	2
Femur	1
Total	**5**

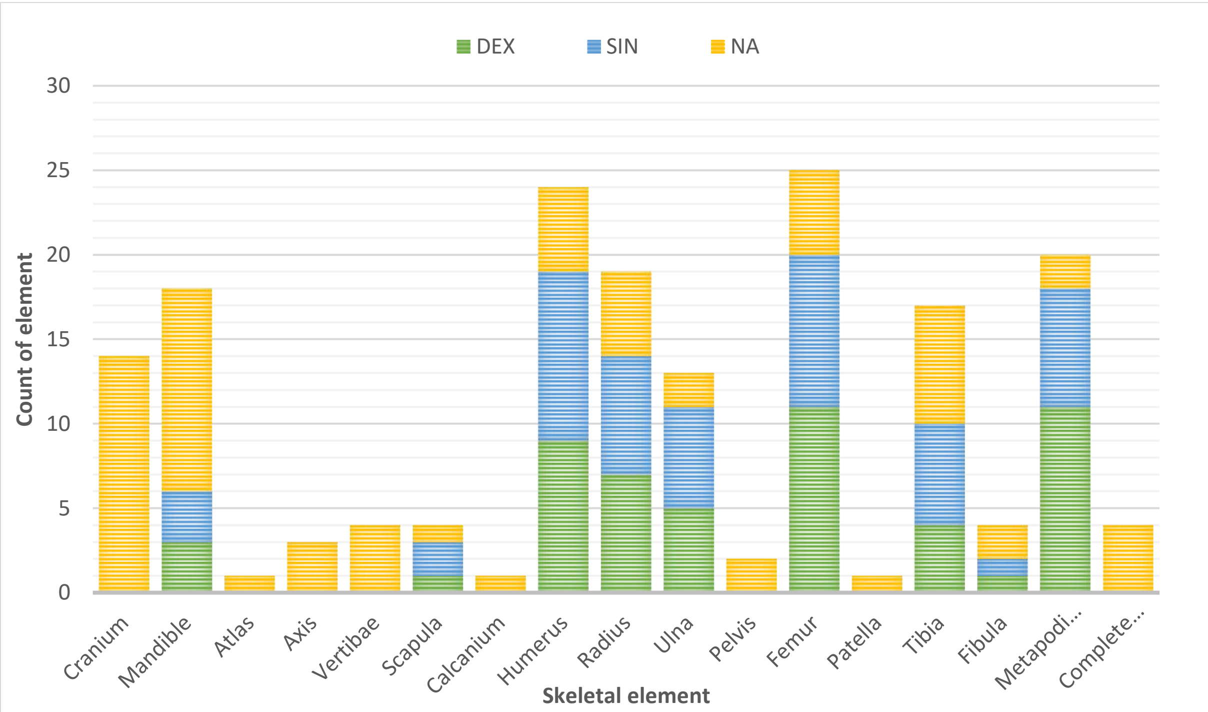
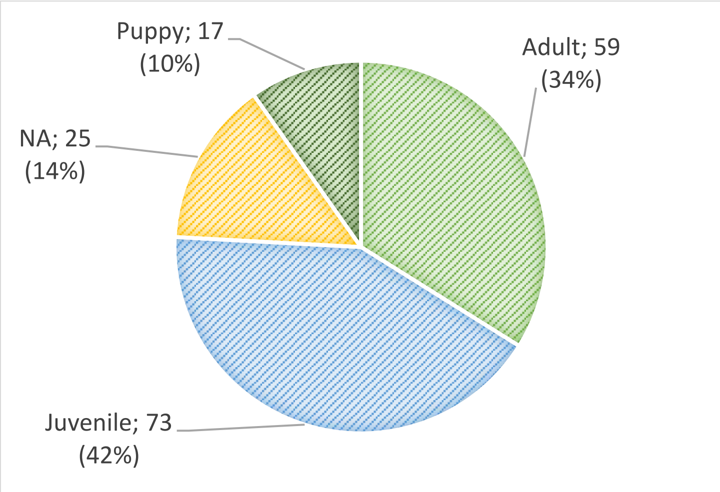


Figure 20 The elements of the dogs, divided trough sides (right: DEX; Left: SIN)

6.2 Age estimation and age profile

Providing information on their age at death has been of importance for the study. A good amount of dog remains provided age information, 86% (Figure 18). Interestingly, juvenile dogs and not puppies are the most represented, which does not correspond with a natural mortality profile where a higher number of new-borns die (Lyman, 1987, p. 138).



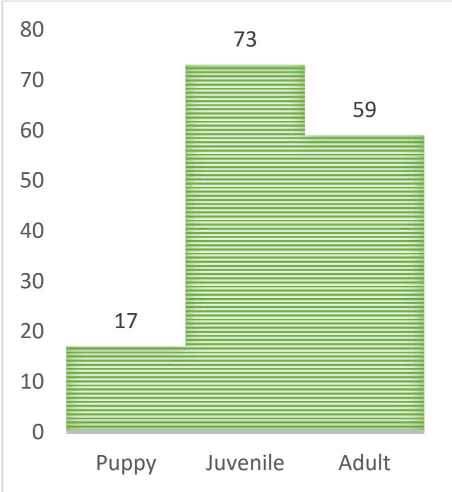


Figure 21 Number of elements and their frequency per age categories of the studied dogs. Puppy (0-6 months), juvenile (6-24 months) and adult (24+ months) (by R.L. Roelofsen-Menting).

Figure 22 Age profile of the dogs that could be categorised (by R.L. Roelofsen-Menting).

The results indicated that 52% of the individuals were definitively either puppies or juveniles (Figure 21; Figure 22). Altogether, more than half of all the dogs were unlikely to be mature and had not attained full developmental maturity. The remaining individuals (48%) were adults (34%) or it was impossible to identify the elements in terms of their age (14%). These age estimates can only indicate the relative youngest age, so it is possible that many of the dogs had reached developmental maturity (Gene, 2018, p. 101).

Interestingly, there is a low number of puppies present in the data, given that in a normal mortality profile, or U shape, should be higher. Several possibilities for an explanation can be found for the low result in puppies. It is possible that these bone fragments were less well preserved and thus not found and/or recovered by the excavators. Alternatively, the burial or deposition of puppies was conducted outside the anthropogenic site centre.

6.3 Size estimation

6.3.1 Body mass

As described in the methodology, chapter 5.5.1, the Losey (2014; 2017) formulae were used. To provide a clear outline, a simplified form of the basic equation is reiterated below, which is then utilized in Table 10:

$$\underline{\text{Body mass}}\ (kg) = 10 \wedge (\alpha + \beta * LOG10(R))$$

Ultimately, the linear regression equations for dog limb dimensions and body mass were not applied, as the formula in Losey et al. (2017) made reference to the formula for the measurement of linear regression equations between dog cranial and mandibular dimensions and body mass (Losey et al., 2014). However, it was not possible to apply this formula except when using additional programmes and systems such as SPSS Statistics 22.0, which was not accessible. Additionally, this methodology could not provide supplementary information, as it could only be applied to the individuals that had already been examined with the method of Losey et al. (2014). The use of the additional method could validate or invalidate the outcomes of the results to the formula for the measurement of linear regression equations between dog cranial and mandibular dimensions, so it was concluded that this methodology was not applied.

These four elements which were calculated originate from two different sites, Leiden Roomburg and Spijkernisse (Table 10). The three dogs from Leiden Roomburg have a mean body mass per individual of 10.6 kg, 21.6 kg and 28 kg. This difference is significant, as jumps of 10 kg are observed, and herewith it is possible to consider that several different types of dogs are involved. However, it is necessary to take into account that individual LR_46/5/545 is a female and a puppy, where individual LR_46/5/516 is an adult male while, for the other two, their sex or age is not known.

Mandable		VVDm1	VVDm2	VVDm4	VVDm8	VVDm9	VVDm10	VVDm11	VVDm12	VV
LR_46/5/545_Man_S	Raw measurement	111,8	113,8	97,6	61,4	57,2	28,5	n/a	n/a	17
	Body mass (kg)	9,090	10,050	10,292	10,892	12,277	n/a	n/a	n/a	13
LR_46/5/516_Man_S	Raw measurement	147,7	146,9	127,7	77,8	72,6	34,4	n/a	n/a	21
	Body mass (kg)	20,047	20,074	20,741	20,615	21,985	n/a	n/a	n/a	21
LR_11/5/96_Man_S	Raw measurement	n/a	n/a	145	82,5	79,9	39,7	n/a	n/a	25
	Body mass (kg)	n/a	n/a	28,886	24,146	27,786	n/a	n/a	n/a	29

Spijk_17/07_Man_D	Raw measurement	n/a	n/a	n/a	n/a	n/a	n/a	40,8	35,6	n/
	Body mass (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/

Table 10 Results from the statistics for linear regression equations between dog mandibular dimensions and body mass. VDD is Von den Driesch (1976); by R.L. Roelofsen-Menting.

Element and location		**VVDm1**	**VVDm2**	**VVDm4**	**VVDm8**	**VVDm9**	**VVDm10**	**VVDm11**	**VVDm12**	**VVDm14**	**VVDm18**	**VVDm19**	**VVDm20**	**Avarage body mass (kg)**
LR_46/5/545_Man_S Leiden Roomburg	Raw measurement	111,8	113,8	97,6	61,4	57,2	28,5	n/a	n/a	17,4	42,2	17,6	15,1	
	Body mass (kg)	9,090	10,050	10,292	10,892	12,277	n/a	n/a	n/a	13,375	10,043	9,478	9,823	**10,591**
LR_46/5/516_Man_S Leiden Roomburg	Raw measurement	147,7	146,9	127,7	77,8	72,6	34,4	n/a	n/a	21,7	56,8	26,4	21,7	
	Body mass (kg)	20,047	20,074	20,741	20,615	21,985	n/a	n/a	n/a	21,327	19,896	25,141	24,657	**21,609**
LR_11/5/96_Man_S Leiden Roomburg	Raw measurement	n/a	n/a	145	82,5	79,9	39,7	n/a	n/a	25,1	n/a	28,5	22,8	
	Body mass (kg)	n/a	n/a	28,886	24,146	27,786	n/a	n/a	n/a	29,008	n/a	30,224	27,954	**28,001**
Spijk_17/07_Man_D Spijkernisse	Raw measurement	n/a	n/a	n/a	n/a	n/a	n/a	40,8	35,6	n/a	n/a	23,5	18,7	
	Body mass (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	19,002	16,902	**17,952**

Mandable		VVDm1	VVDm2	VVDm4	VVDm8	VVDm9	VVDm10	VVDm11	VVDm12	VVDm14	VVDm18	VVDm19	VVDm20	Avarage body mass (kg)
LR_46/5/545_Man_S	Raw measurement	111,8	113,8	97,6	61,4	57,2	28,5	n/a	n/a	17,4	42,2	17,6	15,1	
	Body mass (kg)	9,090	10,050	10,292	10,892	12,277	n/a	n/a	n/a	13,375	10,043	9,478	9,823	10,591

LR_46/5/516_Man_S	Raw measurement	147,7	146,9	127,7	77,8	72,6	34,4	n/a	n/a	21,7	56,8	26,4	21,7	
	Body mass (kg)	20,047	20,074	20,741	20,615	21,985	n/a	n/a	n/a	21,327	19,896	25,141	24,657	21,609
LR_11/5/96_Man_S	Raw measurement	n/a	n/a	145	82,5	79,9	39,7	n/a	n/a	25,1	n/a	28,5	22,8	
	Body mass (kg)	n/a	n/a	28,886	24,146	27,786	n/a	n/a	n/a	29,008	n/a	30,224	27,954	28,001
Spijk_17/07_Man_D	Raw measurement	n/a	n/a	n/a	n/a	n/a	n/a	40,8	35,6	n/a	n/a	23,5	18,7	
	Body mass (kg)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	19,002	16,902	17,952

6.3.2 Shoulder height

The estimated shoulder heights were calculated from the total length of the longbones according to Harcourt (1974, p. 160) and are presented in Figure 23. There are peaks in the chart between 27-31 cm, 34-35, 45-46, 64-67 and 72-74, but most dogs seem to be between 57 and 63 cm. Considering figure 20, it is evident, as before, that big dogs constitute the majority of the individuals, followed by medium-sized dogs and, finally, closely followed by small dogs. The larger group consists the dogs with a shoulder height of 62-63 mm. When comparing this with modern breeds, this would be comparable to a modern German Shorthaired pointer or a Dobermann.

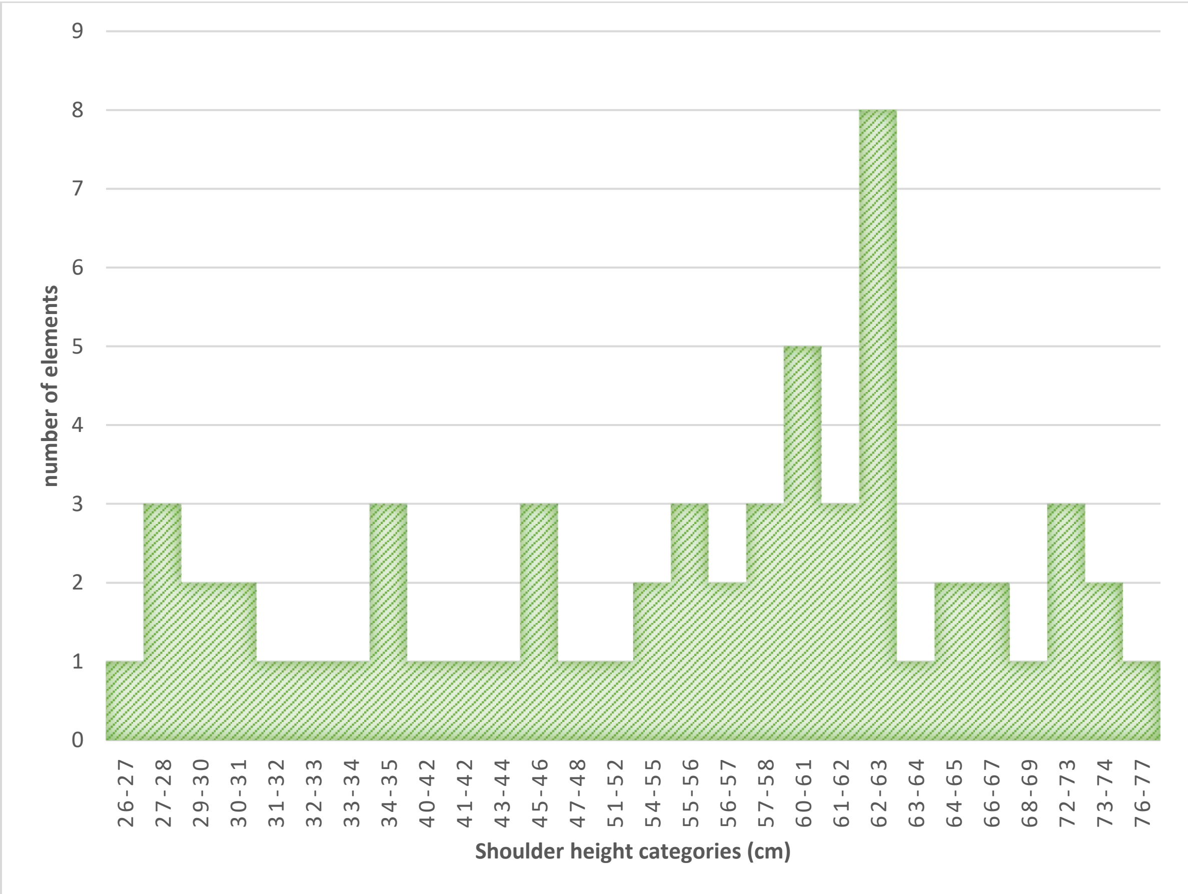


Figure 23 The shoulder hights presented in categories (by R.L. Roelofsen-Menting).

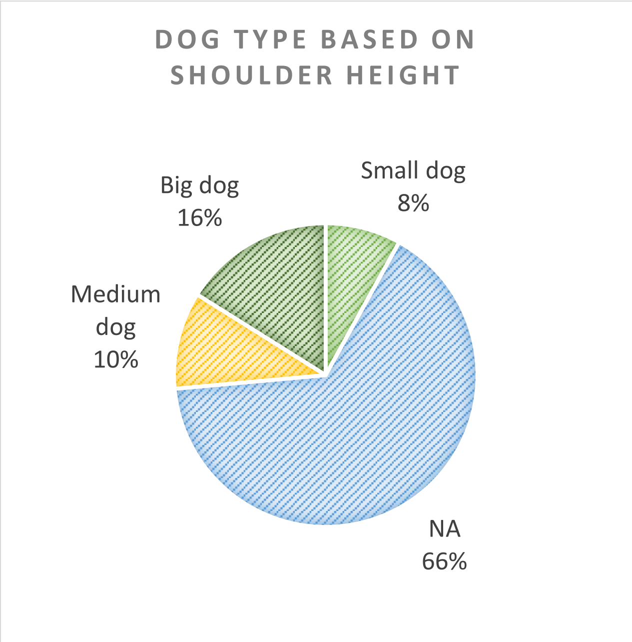


Figure 24 Dog type present in the research based on shoulder heights (by R.L. Roelofsen-Menting).

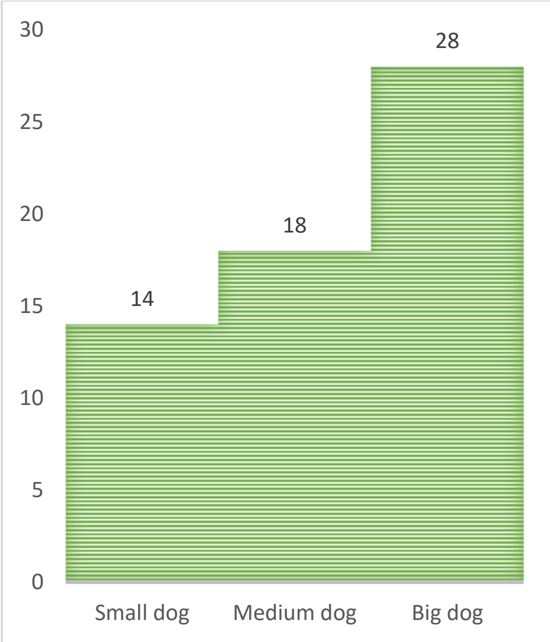


Figure 25 Size profile of the dogs that could be categorised (by R.L. Roelofsen-Menting).

6.4 Skull and mandible measurements

There are 14 crania that have been included into the database, but regrettably only one cranium results from own measurement research, making detailed measurement data scarce. The skull resulting from own measurement research is from the Leiden Roomburg site (Figure 26; LR_46/5/516_Cr). It is not known, however, within this study, where the individual was found. The following provides a summary (Table 11) of the main skull measurements.

Table 11 Overview of the skull measurements (all measurements in mm; by R.L. Roelofsen-Menting).

	Von den Driesch (1976) Number	**Result (mm)**
Skull length	C1	198,7
Cranial Width	C29	53,6
Cranial height	C38	56,2
Facial length	C8	93,6
Facial width	C30	109,9
Snout Length	C12	81,1

	Von den Driesch (1976) Number	Result (mm)
Snout width	C36	40,7
Palatal Length	C13a	95,7
Palatal Breadth	C34	66,4
Mandible Length	M1	147,7
Mandible Height	M8	77,8

The skull classification according to total length reveals that it measures 198.7 mm. When compared with Hasebe's (1952) skull classifications using the data from table, it appears that the skull matches the medium category.

6.4.1 Cephalic index

When applying the facial indexes to the available skull measurements, a more detailed picture emerged. Using the samples, the cephalic index (the ratio of the width of the skull to the overall length) exemplified a medium-sized skulls. The lack of skulls with the necessary dimensions limited the interpretation. This index is most likely biased towards larger dogs considering this is an adult male.

The Cephalic index was calculated according to the formula outlined by (Grieve, 2012; Harcourt, 1974; Von den Driesch, 1976)

Basic formula, as described in results: (C30) x (100/Total length (C1))

Cephalic index of LR_46/5/516_Cr = (C30) x (100/Total length (C1))

LR_46/5/516_Cr = 55,3 mm

6.4.2 Snout index

The Snout index was calculated according to the formula outlined by (Grieve, 2012; Harcourt, 1974; Von den Driesch, 1976)

Basic formula, as described in results: (C8) x (100/Total length (C1))

Cephalic index of LR_46/5/516_Cr = (C8) x (100/Total length (C1))

LR_46/5/516_Cr = 47,1 mm

6.4.3 Snout width index

Snout width index compares the length of the snout to its width The Snout index was calculated according to the formula outlined by (Grieve, 2012; Harcourt, 1974; Von den Driesch, 1976)

Basic formula, as described in results: (C8) x (100/Total length (C1))

Cephalic index of LR_46/5/516_Cr = (C36) x (100/ Viscerocranium length (C8))

<u>LR_46/5/516_Cr= 43,5 mm</u>

Figure 26. Cranium, Individual 1, Leiden Roomburg (pictures by R.L. Roelofsen-Menting.

6.4.4 Conclusion skull indexes

The width of the cheekbones could rarely be acquired as the cheekbones on the side of the skull are prone to being damaged (Grieve, 2012, p. 75-76). The higher the cephalic index, the more brachycephalic the skull shape, e.g., Pekingese (Grieve, 2012, p. 76). The cephalic index (CI) represents the ratio of the maximum width of the head (A) multiplied by 100 divided by the maximum length of the head (B) (Figure 27; Bognár et al., 2021). The shorter the dog's head, the higher the cephalic index. The (CI) index was calculated to be 55.3 mm, which fits medium to large dogs. As observed in Figure 27 from Bognár et al. (2021) this dogs is located within the Mesocephalic head shape.

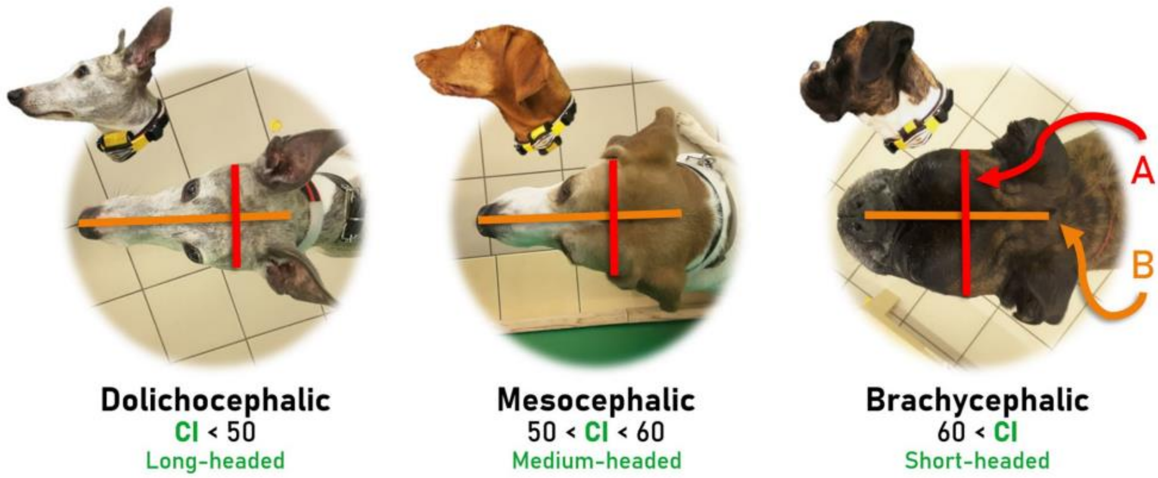


Figure 27 The typical classification of dogs' head shape based on the cephalic index value (CI) (Bognár et al., 2021).

The Snout Index equates the greatest length of the cranium with the width of the snout, a very characteristic as well as variable attribute of a dog's face. The (SI) index is calculated at 47.1 mm. The Snout width index compares snout length to snout width. It (SWI) is calculated to be 43,5 mm.

6.5 Sex determination

From the entire database, just five individuals could be identified by sex, out of which there were four males and one female dog (Figure 28). Crockford (1997, p. 25) gave her comments on the research she conducted on Makah and Coast Salish dogs, where she noted a high ratio of males to females. It concluded that this may be due to a series of reasons, including different burial practices for the sexes or females were put to death in an attempt to control the size of the dog population. Similarly, removing female dogs before they reached six months of age would have been beneficial in minimising fights between males whenever a female went into heat.

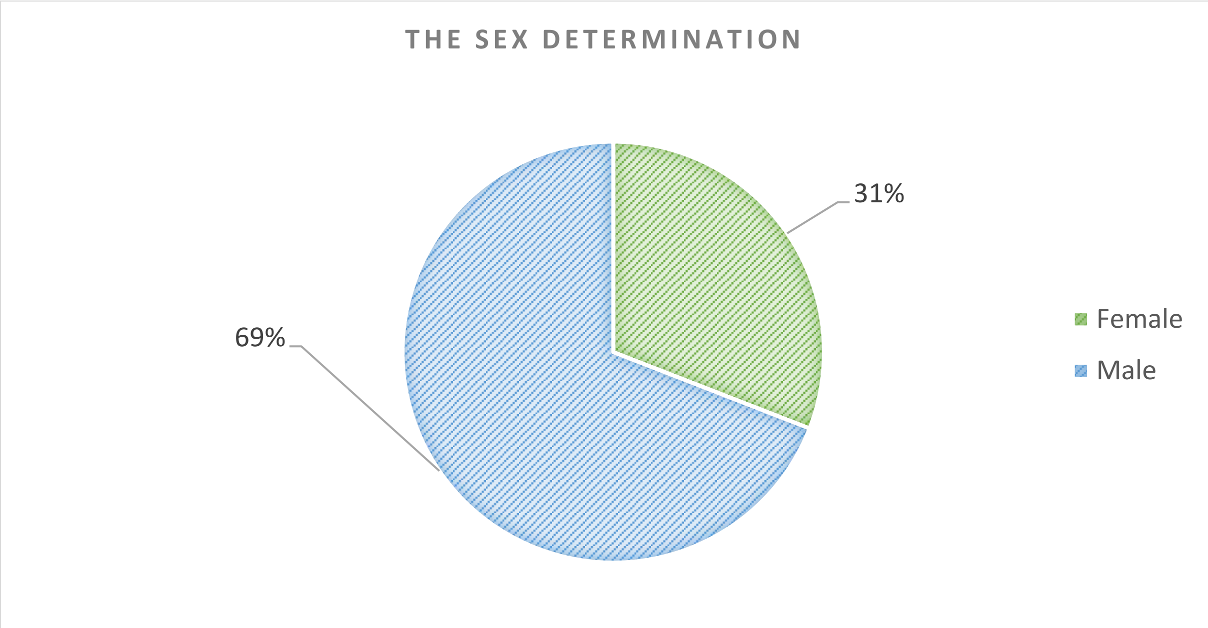


Figure 28 Sex determination (by R.L. Roelofsen-Menting).

6.6 Burial location

Burial location refers to the term applied to identify the context in which the dog bones have been excavated, in addition it could specify the manner in which the dog was disposed of following its death (Grieve, 2012, p. 37). It was possible to analyse a cumulative total of 38 special deposits derived from the Tiel-Passewaaij site. In the case of the other assemblages of Tiel-Passewaaij, the ritual nature or otherwise of the burials could not be determined with certainty. One such example is a dog skeleton found in a pit together with parts of a red deer. Wild animals are typically only found in small numbers, making this an unusual find. It is difficult to say anything about the occurrence of the different types of deposition through time, because the numbers are too low for that. Moreover, there is a relationship between type of deposition and species, and the two are difficult to separate (Groot, 2008, p. 36).

At Tiel-Passewaaij, it can clearly be seen that the number of ritual deposits increases from phase 3/4 (40-120 AD) and peaks in phase 4-5 (140-210 AD); thereafter the number decreases again, showing some ups and downs (Figure 28) (Groot, 2008, p. 36-37).

Animal burials and separate craniums are found in many excavations. However, a more particular though problematic categorisation is that of bone concentrations. This is a problematic category due to the fact that this is precisely what is typically seen as offal: i.e., a pit filled with separate bones. Several aspects distinguish bone concentrations from 'normal' offal, however (Groot, 2008, p. 36-38).

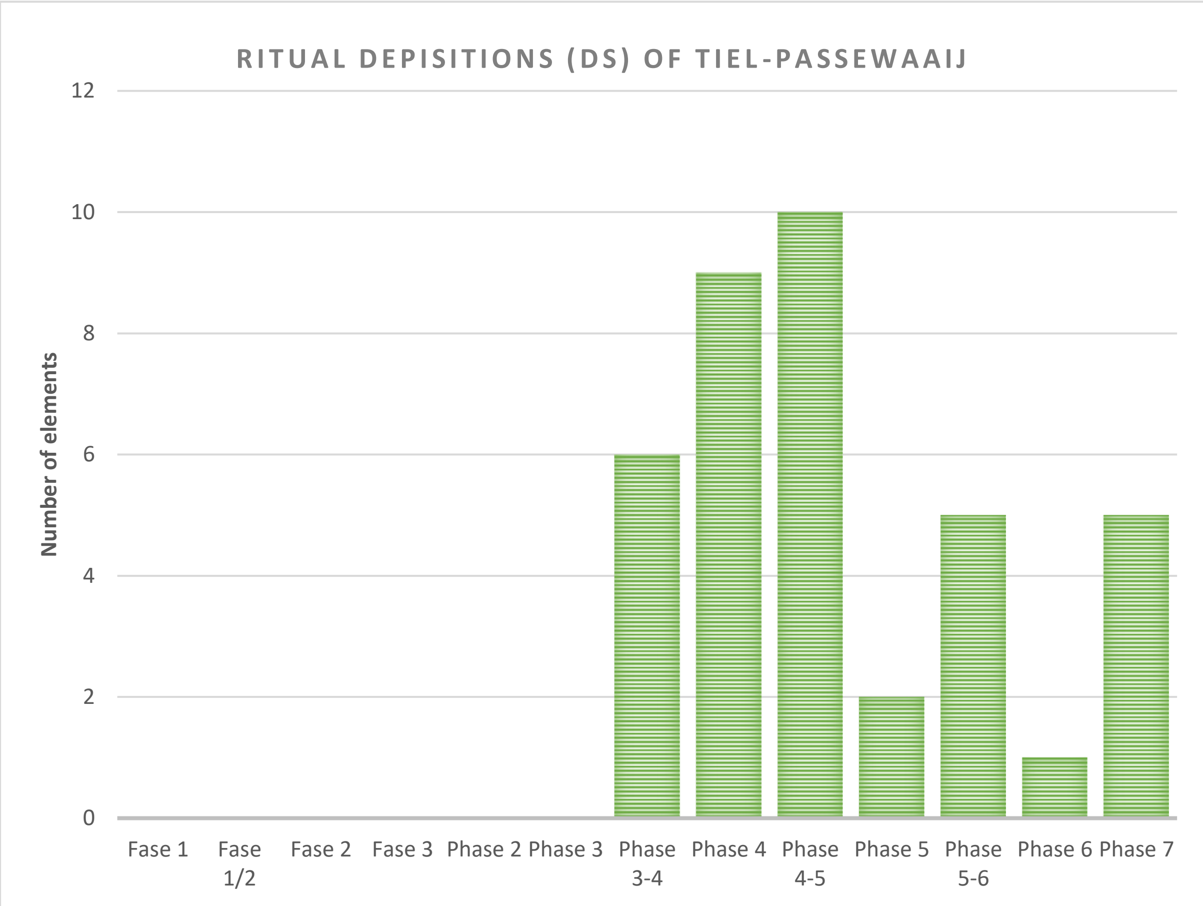


Figure 29 Ritual depositions, divided into the phases in Roman habitation, of Tiel-Passewaaij (by R.L. Roelofsen-Menting).

So, what is the significance of special deposits? Not every special deposit is a ritual deposit; for this reason, it is wise to talk about special deposits as long as they have not yet been interpreted as ritual. Some of the depositions almost certainly occurred during ritual acts (Groot, 2007, p. 36-38). These rituals had different functions. The location of ritual deposits in house trenches indicates an interpretation as construction or abandonment offerings of a house. In this sense, they are similar to building offerings of pottery in post pits of middens (Groot, 2007, p. 37-38). Deposits in fence trenches around the yard may have served as protection for the yard, but also to mark the boundaries of the yard. A relationship with fertility, for both livestock and crops, is obvious for at least some of the remaining deposits, given the importance of agriculture and the frequent occurrence of fertility rituals in societies around the world. In the case of the large bone concentrations, we should rather think of the remains of a feast. Perhaps the need for different types of rituals was not always the same through time, so some were performed more in certain periods than others. However, no judgement can always be made on this, as the location of the excavations, excavation methods and documentation may give a distorted picture. Shortly after a disastrous event happened, rituals may have been performed more frequently (Groot, 2007, p. 38).

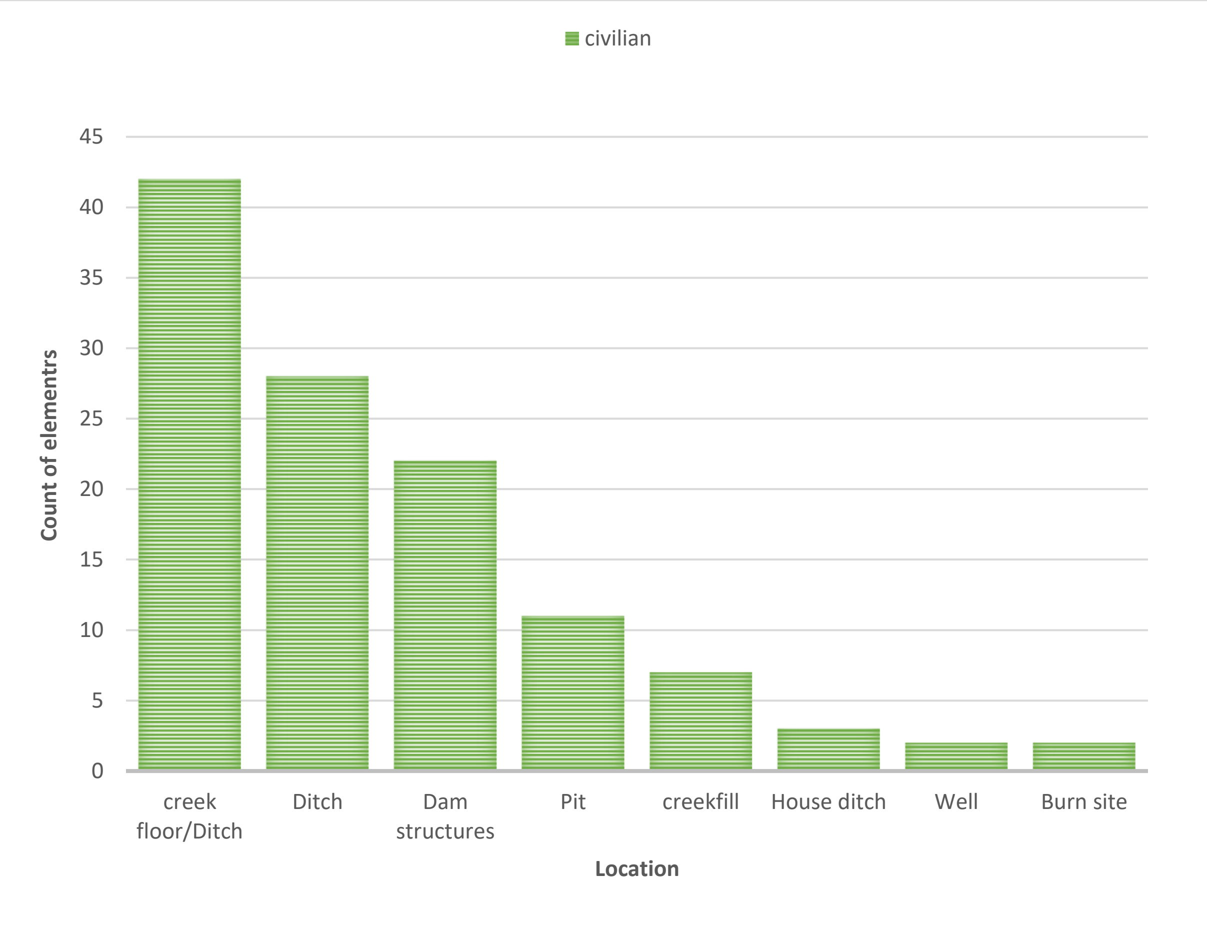


Figure 30 Number of elements found in a specific burial location on a civilian site (by R.L. Roelofsen-Menting).

By applying a variety of criteria, on average, more than half of the deposits could be classified as rituals. Ritual deposits are common throughout all Roman occupation phases and contain remains of both domestic and wild animals. In in some phases, ritual deposits appear to have been intentionally buried near houses or in enclosure trenches. This suggests that rituals involving the burial of animals were related to the protection and marking of property sites and the home (Groot, 2007, p. 38).

6.7 Butchery

Overall, none of the dogs showed signs of slaughter, with a few dog bones suggesting they were skinned. As such, an indication that the use of dogs, whether for meat or skin, was not a common practice is suggested by this scarcity of recorded signs of slaughter from all survey reports and my own research.

6.8 Care

Identifying, describing and quantifying the pathological conditions represent the vital preliminary steps in evaluating the health and welfare of animals derived from osteological remains. However, does it also covey the care that is given to the animal? First of all, it is very important to state once more that the sample size is relatively small. Evidence of dog bones was not consistently recovered (or recorded) from all these sites, nor were pathological conditions found on bones generally reported inconsistently in all contexts, or indeed identified initially. Whether a lack of recording genuinely implies the absence of skeletal abnormalities may not always be readily determined (MacKinnon, 2010, p. 304). While none of the identified dog bones from my own osteometric research and from the reports where faunal materials were collected and reported support any evidence of a single pathological condition. Generally, Roman dogs would appear to have been in good health, from an osteological perspective at least.

However, compared with other domestic animals, dogs, cattle and horses display, in general, the highest occurrence of skeletal pathologies, an observation which is also consistent throughout numerous regions and time periods (Siegel, 1976), which is add odds with the previous statement. Anthropogenic investment into veterinary care as well as the tendency of dogs, oxen and horses to become or stay older contributes to explain this result (MacKinnon, 2010, p. 3-1), as older individuals are more prone to have ailments. In terms of tooth loss, the fourth premolar and first molar, both maxillary and mandibular, seem notably susceptible in comparison to other teeth. However, tooth loss might be due to other diseases or an issue of poor genetics. In the majority of these cases, the dog will do fine without the tooth and live for some time afterwards (MacKinnon, 2010, p. 302). This may, however, be an indication of care, as this dog was either fed special food or even hand-fed by the caregiver.

MacKinnon (2010, p. 302) notes that older and/or smaller type dogs tend to have more ailments and thus may indicate more or less care than when compared to a younger dog. However, since more than half of this study exists put of younger individuals, it is likely that this false high level of care is being negated. Age could therefore be a factor to consider, but the temperament of smaller dogs may also play a contributing factor (Baranyiová et al., 2009, p. 14-107), as well as a higher level of human care for these 'pets'.

Furthermore, it is reasonable to hypothesise that there may have been some concern for dogs suffering from mobility problems (e.g., Settefinestre skeleton 3, Pompeii, Marseilles; MacKinnon, 2010) since, if not otherwise kept as 'pets', such disabled, crippled and osteoarthritic individuals were perhaps incapable of successfully foraging for food in the absence of human intervention. As Harcourt, (1974) deduces a somewhat comparable situation of empathy and owner assistance for a fox terrier-sized 'pet dog' belonging to a Romano-British site in Suffolk, England, that suffered osteophytic lipping and ankylosis in several of its lumbar vertebrae and had severe osteoarthritis in both his left and right elbow and knee joints.

In ancient Roman veterinary texts, cures are recorded for several conditions in livestock, which included splinting and bandaging broken bones and wounded legs. Mackinnon (2010) notes that evidence of badly set bones (e.g., Matrice, Settefinestre-skeleton 2, Rome-Meta Sudans, Yasmina, Marseille; MacKinnon, 2010) implies the lack of human intervention in the treatment of the broken or dislocated bone by itself, however this does not suggest there was no other care involved in feeding or caring for the animal. Some examples of fractures that healed relatively naturally, with little or no dramatic displacement (e.g., metatarsals from San Giovanni, fifth metatarsal from Settefinestre skeleton 3; MacKinnon, 2010) do not inevitably indicate human intervention, as these types of healed fractures may have resulted from natural anatomical splinting (Udrescu & Van Neer, 2005, p. 24-33).

Baker & Brothwell (1980) detected a tendency for traumatic injuries to the face, from the area above the eyes to the face of the snout, in a sample of dog skulls from the Neolithic to the Roman period. Hypothetically, the injuries might be attributed to being struck or fended off from an aggressive dog. The general impression is that these animals were (fortunately) not maltreated, or at least not to an extent that resulted in bone fractures. Now, what can the zooarchaeological evidence effectively reveal about the human care of dogs?

One potential contributing factor can be found in the care one had for the animal at the time of its, or the carers', death. In Spijkernisse, a dog was found in a human's grave, which was possibly an additional gift as the dog was the woman's or due to the fact that the dog was a symbolic sacrifice. In this regard, the dog from Spijkernisse is a unique within this assemblage. It is possible that this was coincidental due to the limited size of the examined dogs.

CHAPTER SEVEN: DISCUSSION

As described in chapter three, according to our current information the Greeks and the Romans were the first to take animals as pets. Whilst it is certainly feasible that this had occurred before then, these cultures, as described previously, were oriented towards keeping certain animals as pets. It is thus reflected in both the literary and depicted sources while it is also reflected in the various aspects of their lives and the mindsets that resulted from it. Throughout the Roman period an increasing quantity of text concerning the dog has been produced, wherein it shows the dog is not merely a support animal, but also a companion. The roles that have been written about suggest a wide-ranging selection. In this regard, it might be the case that the dog gained an increasingly privileged and unique position in the Roman culture, but it might also have been a pre-existing phenomenon that simply became more prominent in texts as the Roman period progressed. An indication that the dog acquired an increasingly special position can be found in the ritual deposits found within this study. In this regard, a distinct starting period is in fact apparent from phase 3-4 (40-120 AD) onwards.

In terms of morphology, contemporary dogs are utterly dissimilar to each other. This is hardly surprising, given that the dog has the greatest number of morphological typologies in the animal kingdom (Bennett, 2012, p. 32). Nevertheless, dogs dating back to the Roman period, as far as is known, do differ between regions as well as within a single region, such as described by Cato et al, (2006), Fitzgerald (2009) and Toynbee (1973) and in chapter 3. Additionally, the variety of different types of dogs for a given task and the meaning of a role itself differ to contemporary roles as well (chapter 3.2). While the broad and massif dog that was preferentially chosen as a working dog in Rome was certainly found in the assemblage, so too were the preferred long and slender dogs. When this information is implemented, one can indeed discuss working dogs within the assemblage with the tall and massive dogs constituting a major part within this study. Besides the large, massive dogs and the tall, slender dogs, there was also an increase in popularity during Roman period for smaller dogs, such as the Jack Russel. These were used in many regions due to their speed during hunting. However, the role of hunting is ruled out for the Rhine Delta region. Nevertheless, a considerable number of small dogs were identified (chapter 3.2; 6.3.2), as is evident in the peak in Figure 23 and in the distribution of the different sizes in Figures 24 and 25. These dogs displayed no discernible pathologies, suggesting it is quite plausible that they lived quite close to the household and may have performed a non-hazardous supporting task in addition to being a companion animal. Driving off rodents and small wildlife from the home or perhaps still occasionally helping to hunt small game with its owner could be examples.

This research identified significant morphological differences, but was it considered common for the Roman period? Were dogs also very diversified in morphology and functions in other regions of the Empire? Both studies by Mozzorin and Taglicozzo (1997; p. 439) and Bennet (2012; p. 32-33) included some well-defined varieties, which is comparable with this thesis research. Research by Mozzorin and Taglicozzo reflects the resulting findings on the Italian Peninsula while research by Bennet has been conducted in the United Kingdom. Geographically, the two sites are considerably different from one another and their distance from Rome itself also differs greatly. The research described in my own study is of closer proximity to Rome than the research of Bennet (2012) and the research from Mozzorin and Taglicozzo (1997) is closest to Rome out of the three studies involved in this comparison.

In the study on the Italian peninsula, dogs were present with significant variations regarding their size and overall shape of the cranium, but this was only distinguishable in the late Roman period. In contrast, Bennett (2012; p. 32) indicates that 'the Roman invasion of Britain marked the beginning of an era of much greater variability'. The period of the Roman invasion occurred at approximately 40 AD and this is also somewhat later in the Roman period. However, the current study did not distinguish between different periods or phases within the Roman period, except the dogs discovered in a ritual deposition. Consequently, no further statements can be made regarding this aspect.

Nevertheless, when considering the results of the complete Roman period within the study, it is certainly feasible to discuss a similar diversity as indicated in the research of Mozzorin and Taglicozzo (1997) and Bennet (2012), in which the small dogs decrease in size and the large dogs increase in size (Harcourt, 1974). Bennet's (2012) Vindolanda assemblage comprises cranial and postcranial bones from a wide range of dogs, from relatively small (estimated at 34 cm) up to almost equally large as reported in other reports in Roman Britain (estimated at 71 cm). In the present study, the diversity is just slightly greater, which could be a potential consequence of an assemblage dating back slightly later in the Roman period. Here, the smallest is calculated at a shoulder height between 26-27 cm and the largest between 76-77 cm, in which the contemporary variations then comprise a dachshund for the small dog and a Leonberger for the large dog. Altogether, these variations are comparable with the site of Vindolanda. As indicated by Harcourt (1974), the occurrence of miniature or "toy" skeletons is well within the realm of expectations, which was certainly the case within this study and the Bennet's study (2012).

In Mozzorin and Taglicozzo's (1997) study, similarly to my own study, also considered the variations in Dolichocephalic, Mesocephalic, and Brachycephalic dogs. However, they mentioned brachial limbs at two separate sites. Consequently, they have incorporated the post-cranial elements, as opposed to the cranium, and have encountered different types of crania. In this regard, within this study, only a single cranium could be classified as Mesocephalic and an absence of Brachymelic dogs in the first Roman period has been identified by Mozzorin and Taglicozzo (1997). An absence most probably caused by the scarce archaeozoological records for this period. Here they comment: “In fact, Brachymelic dogs occur in this period in several Roman provinces outside Italy.” Mozzorin and Taglicozzo (1997; p. 439). The Mesocephalic skull typology deviates from the research results recorded in both the provinces located outside Italy as well as within Mozzorin and Taglicozzo's research (1997).

Moreover, Mozzorin and Taglicozzo (1997) also refer to the function of dogs in their results and came to a similar conclusion in that, contrary to reported sources, no definite evidence for the slaughter of the animal was found, but rather there were frequent indications of the ritual and funerary uses of dogs.

Most studies mention that a dog was only capable of preforming one single role. However, with the information provided by this study, I concluded that the dog did not fulfil only one role. This deduction is made possible due to the small format of this study, but is seems probable that the dogs in this region of the Roman empire did not perform one singular task. As the majority of the dogs had a size that varied from medium to large dogs, with a few exceptions with smaller (toy) breeds, it is plausible that the majority had active roles in the human community in which they lived. When considering the main role of dogs, hunting is ruled out. It is entirely plausible that the dogs within this study may well have been hunting on one or more occasions, but this would not have been one of their primary roles. When considering the smaller dogs, i.e., toy type dogs, the number of possible roles is reduced slightly, but there is certainly still a possibility of multiple roles to participate in to some extent. The most probable roles which can be applied to the dogs of this study are those of: companion animal, shepherd or guard. Along the line of my expectations, many might have carried out almost every role, with the exception of the small dogs. They are bred in such a way that they may have been able to function solely as a companion and potentially only survive while kept as companions.

Alternatively, it is possible to use dogs’ faeces to raise leather, which could be done whether the dog was small or large. Although it could have impacted the amount of faeces that could be collected. Goodburn (1978) lists the use of dog, pigeon, and human faeces in the tanning process as a means of softening leather. The skins would be washed together in a mixture of dog manure and bird dung, thereby removing the lime (Semple 2006). Whereas the tannery would treat the skins of all cattle and sometimes horses, the skins of goats, sheep, deer, horses and hunting dogs went to the tawyer (Grieve, 2012). Semple (2006) reports the tanning process carried out at Wrotham Manor (dated around 1400

AD). Up until then, tanners would use dogs to clean the hides of cattle for tanning by using their teeth. Jones (2002, 128) reviews the skins of smaller animals, including dogs, that were used to make leather for gloves, pouches, and shoe soles. This would have major implications for the animals whose faeces would be gathered, given that they would have to remain where it was convenient to collect the faeces. In such a setting, the animal would have lived in close proximity to humans and a companionship is then likely. A different relation was identified in the connection between the dog and the sea, in which the goddess Nehalennia features an important role.

Only recently researchers have started to include the study of the relationship between humans and other animals, which was astonishing. As animals have a considerable impact on lives of humans it is a special factor in the whole context of a site. A possible reasoning behind this could be that keeping pets as a social feature has traditionally been dismissed as frivolous and sentimental in the archaeological community and was therefore considered of no importance. This has always been a part of archaeology, since the archaeologists classify what should be investigated and this is where a decision is made on where their focus should be devoted to. For this reason, it is sometimes possible to adopt a short-sighted and contemporary approach, rather than thinking of the optimal approach in order to unravel the 'puzzle' of the site or location. Nowadays, archaeologists refrain from casting investigations in a too contemporary setting. A recent influencing factor is financial pressure, as a majority of Dutch archaeological excavations comprise rescue research. As a result, many additional investigations, such as animal bone research, are conducted less or not at all. The aforementioned does not include the significance of what the thus missed materials might inform us about the way people lived at the site. On the other hand, relationships are now considered legitimate and unique aspects of the human experience.

7.1 Limitations

One of the repercussions of the current manner in which modern archaeology is organised is the fact that the majority of excavations in the Netherlands are rescue excavations. This implies that the location of an excavation is determined by its suitability as a construction site rather than based on its scientific potential. Nevertheless, rescue excavations can contribute to academic research. The excavations sites that were included in this study are evidence that data accumulated in rescue excavations can provide further insights into the participation of dogs. This is particularly the case with off-site areas or regions neighbouring an important archaeological site. When conducting a survey on a targeted site, one can easily hyperfocus on that region and neglect the surrounding areas. The way rescue excavation works is that it often investigates that too. This makes it a confining, but simultaneously an enabling opportunity to delve more deeply into the archaeological puzzle.

Due to covid-19 restrictions, it was not possible to conduct additional research on this supplementary bone assemblages, which would have provided more information. Increased funding ought to be made available for the rescue excavation projects which either fit into academic research programs, or fit into the research themes outlined in the Dutch National Research Agenda (Groot, 2008a; 'Nationale Onderzoeksagenda Archeologie'), as more in-depth analysis can be performed if the basics are addressed.

A problem noted in archaeological reports when discussing dog remains is the assumptions made about a dog's function based on its shape and size. Harcourt (1974, p. 171) noted: "size alone, however, is an unreliable guide to function". For example, Baxter (2006) commented that a small dog excavated from a Roman-British tomb was very similar in appearance and habit to the dachshund, which would indicate that it was used to hunt burrows (Grieve, 2012).

So far, I have discussed the limitations that precede in-depth research such as this study, but I now want to focus on issues that may be limiting during this research and when conducting future studies. Future research such as this study might also be constrained by the previously discussed issues, as they carry over into every subsequent research, assuming it is not fully developed from its initial stages.

Despite the potential of animal bone collection, there are limitations in terms of what animal bones are capable of conveying to us. Among the difficulties is the fact that the number of animal bones collected from some phases is comparatively limited. Conclusions drawn from those phases are bound to be more tentative compared to those drawn from phases containing larger quantities of bones. The extent of the cemetery assemblage is also much more limited than desirable. A second difficulty arises from the fact that some methods of determining age at death differ among sites. As a result, all the data obtained across settlements cannot be easily compared. Finally, because of covid-19, it was difficult to analyse the equipment, but it does not seem to be causing any issues at the moment now that we are no longer experiencing problems with this. This will hopefully remain unchanged. Unfortunately, though, there is a prediction that more of these diseases will emerge, so it might be a worthwhile suggestion to consider whether there is a possibility of conducting research with material from several depots nonetheless. Since, if I had been possible, I would have preferred to conduct this research using only my own measurements for additional detail and a degree of certainty in using only my own observations.

CHAPTER EIGHT: CONCLUSION

"The bond with a true dog is as lasting as the ties of this earth will ever be."
(Lorenz, n.d.)

It was the primary objective of this study to explore the relationship between humans and dogs in the Delta region of the Netherlands during Roman times and to try to understand how people perceived, utilised and handled their dogs. The primary focus fields included canine function or role, morphology and management or treatment.

This study mainly focussed on one community, namely Leiden Roomburg, but was supported by various other sites. One of the strengths of the dataset is that the main data has been obtained by my own measurements, instead of sourcing all the information from scattered measurements of various researches. During my own research, I could implement whatever analyses I thought would be beneficial to this study, instead of what was available from literature. In addition to my own measurements, other site material has been added to conduct validated research.

The value of the study of archaeozoological material has been acknowledged quite recently. Being someone for whom animal companionship has been beneficial, I was touched by studying a small portion of the manner in which relationships with dogs affected and shaped the lives of Romans. When we study society in ancient times, we are often overwhelmed by the so-called "hard facts" of the past. Personally, I always been more interested in studying the social history in addition to those facts. Studying what people actually did for their enjoyment or day-to-day activities, as well as how people saw and treated their surroundings. While seemingly not as significant as political history, this provides a more balanced perspective. The 'hard' facts sometimes appear so very remote and by getting close to the people and their environment, a more accurate and deeper connection can be found. Perhaps this can lead to a better understanding of our history that is appreciated by not just archaeologists, but also the average person. When one understands the work of another, more research can potentially be enabled. Exploring the relationships between Roman people and the dogs not only reveals a different perspective on their daily lives, but it also provides us with a glimpse into their private lives. At the same time, it is painful to contemplate that one can perform certain deeds to such a loyal animal, for what I, and much of today's assemblage, cannot comprehend.

Based on the data reported above, it is possible to make some concluding remarks about the morphology and size of dogs in the Delta region of the Netherlands in Roman times. Within at least one site, a dog is present with a Mesocephalic cranium.

The absence of the other type of skulls is due to the scarcity of archaeozoological documentation in the remaining documentation of the excavations. Apart from the most plausible albeit difficult to prove utilisation of the dogs for work, zoological documentation shows the occasional use of the dog as an offering. In the Roman period, there exists no sure record of the slaughter of the animal, but rather frequent references for the ritual and funerary use of dogs and the skinning of dogs.

Religion and the consequential rituals were infused in every aspect of life and sacrifices or offerings were at the very core of these convictions. This is one of several reasons why the depictions of dogs, in various forms, are able to provide a great deal of specific details about the way people regarded them. Utilizing their depiction and what had a part in the regard of perspective in this study. The act of actually having to sacrifice animals was extremely important in some of the rituals but, the aforementioned, it was certainly not something people derived enjoyment from. The Romans considered it an essential part and that included the use of violence against an animal from time to time. It seems contradictory to think that a society that was so closely associated with killing animals would be capable of valuing animals as companions or as close friends. Nevertheless, from contemporary rituals of the same nature as well as what we currently know through historical sources, the majority of cultures draw arbitrary boundaries for themselves within the animal kingdom. The Romans as a nation were, highly probable, adept at subdividing their understanding accordingly.

In some inscriptions it is described in what manner the dog behaved and what care it required for its wellbeing. This includes descriptions, but also depictions of how it rested on laps and sat neatly with its owner or caregiver. It therefore appears likely that, in over 2000 years, the behaviour of dogs had not changed significantly, but instead remained particularly recognisable in their actions. As previously mentioned, the roles the dog performed such as guard dog, lap dog, shepherd dog are extremely important, although in the first instances a guard dog is not merely a living alarm at the door, rather the owner may also regard the animal as a pet. That an animal is very useful would not mean that it is treated solely as a useful 'device'. Despite this, the dog is enveloped in contradicting notions and beliefs. For example, dogs are the equivalent of loyalty, but also cowardice. They are obedient, but also unpredictable. They are domesticated, but ultimately still an animal. They are guardians, but also connected to the Underworld. They can cure, as well as interact with death and the afterlife.

Subsequently, it would appear that the immediate, though unequal, theory prevails: that animals have souls but are inferior to humans. Different people in different ages or regions have diverse relationships with different animals. With great certainty one can conclude that not every Roman liked dogs. However, it can be said that the relationship between the human and the dog is one of master and subordinate.

The findings obtained from the bone analysis indicated that the minimum number of individuals (MNI) should be 97 in total, although the individual reports referred to a total number of dogs per site as well. It appears to be the case that this involved direct examination of the bone material, i.e., the assemblage, which yielded more information than described by the researcher in his or her research report, resulting in a final result of 59 individuals. In terms of counts found in left and right bone material, the distribution was quite equal.

The numbers of puppies, juveniles and adult in the survey are noteworthy as these do not correspond to a natural mortality profile. Potentially, the bones of puppies may not have been well preserved or there were other locations where the puppies have been buried or have been disposed of.

Unfortunately, when calculating the body mass, only my own measurements from the Leiden Roomburg and Spijkernisse sites could be utilised. However, as the other sites are rather consistent in terms of the type of the site, it is conceivable that this may be a partial match. A remarkable aspect to note is reflected in the great diversity of the dog sizes. The four dogs examined with this method have a body mass of approximately 11 kg, 22 kg, 28 kg and 18 kg, which can be compared to the following modern breeds, in that order, a basenji or Irish terrier, a collie or Samojeed, an appenzeller Sennen dog or large Munsterlander and lastly a spitz or a Petit basset griffon vendeen. Most shoulder heights fall in the range of 62 cm to 63 cm, to which a modern German shorthaired pointer or a Dobermann can be compared. These dogs tend to range in the approximately 25 kg and 35 kg weight class. From this, it is possible to record equivalently that the shoulder height may be similar, while the body mass may differ significantly. However, the argument here is that a large proportion of dogs fall within an average of 51 cm and 63 cm in shoulder height with a weight between 20 kg and 30 kg. This is reflected in section 6.3, which primarily represents the medium to large dog. One feature that is quite remarkable is the rather high number of smaller dogs.

Judging from the skull that has been examined for skull indexes, one can conclude that a Mesocephalic dog is currently in the study, but unfortunately nothing else can be observed in this regard. However, the distance of the snout width is below average, which means that this dog has exhibited a slim snout.

In terms of sex diversity, the males held the majority of the assemble. No baculum was encountered among the assemblage, so other methods have been utilized. The higher proportion of males may be an indication that people have minimised the population of dogs by killing the females as pups, the group from whom sex was determined cannot give a definitive answer to this due to the size of the group.

Furthermore, a significant number of individuals have been found in special deposits, focusing on the late Roman period. In addition, many were found in water related areas, which might have a connection with the previously described connection between the dog and the sea. In addition, some were found in ritual locations, such as a house ditch and a burn site, as well as a pit. The latter could possibly also have been a burial ritual for the dog, and the individual from the burn site is known to have been buried with a human. Whether the entire dog passed along with the deceased is not known.

Lastly, the subsequent evidence on the bone material may tell us something about the care, or lack thereof, the dog received, in spite of many ambiguities here. In this case, any pathology on the bones that was present before the examination was considered, as well as which bones were present and what the records can indicate about the role the dog had and how the animals were treated. The dogs from this research have no pathologies or indicators of abuse, making it seem as if the population around the Delta areas in the Netherlands from Roman times had little to no suffering due to human causation. It should be noted that the individuals in this study were quite young and consequently needed less care, as there are less pathologies in younger animals. However, the dog had a special place compared to other animals. This is also apparent in the manner in which people have written about them (chapter 3.4.1) and what is created of the dog's shape in the form of figurines (chapter 3.4.2), which could be supported by the archaeological data from the research sites.

Several dogs were found on the Rhine Delta region over the course of six different excavations. The dogs display a variation in several aspects, such as age, size, weight and the location where they were recovered, as previously described. It is within the expectation that these dogs did perform a variety of roles or served more than one purpose. The roles the dogs performed are diversified but exclude hunting. The smaller dogs have most likely also performed more than one singular role. Although some of these dogs have most likely served mainly as companions or lap dogs, as described in textual and pictured episodes. The human-dog relationship has, in all probability, been a good one and the dog was considered as a special animal.

Dogs were frequently considered more than mere assistants in performing a variety of tasks; in fact, many were loved for no other purpose than the simple enjoyment of their companionship. It is my understanding of the many varieties of relationships that existed between humans and dogs in the Roman world - of utility, in religion, as companions - that helps to shape a more complete understanding of Roman culture. In material terms, people benefited from animals and their existence was enriched by their company.

8.1 Further research

Due to covid-19 restrictions, it was not possible to conduct additional research on this supplementary bone assemblages, which would have provided more information. When these are accessible, it would be beneficial to conduct this research to gain better insight on the dogs that are implemented in the research.

On several occasions during the research, it became apparent that there was insufficient data to draw factual firm conclusions, and for this reason, more elaborate research would be more suitable to develop this topic further. In addition, supplementary methods to confirm or refute the conclusion reached would be a good way to argue the reasoning. Furthermore, in addition to the dog, the cat was introduced to the Netherlands by the Romans and would make an interesting case for the correlation between dogs and cats in research sites and potentially reveal further data on the, possibly overlapping, roles they may have performed during their lifetime at the Rhine Delta area during the Roman period.

Furthermore, it became apparent during the course of this study how infrequently we, as Dutch archaeologists, actually undertake research with the animal bone material collected in Dutch rescue excavations. Regardless of the fact that these are rescue excavations, more research should and must be undertaken. After all, when this is performed, only then progress can be made towards a comprehensive picture of certain aspects of human life, such as how they interacted with their animals.

At the moment, a lot of changes are in progress in the depots of the Netherlands to make them more accessible and to ensure that people are aware of the contents. Every step taken in terms of improved access is one step forward. In this regard, however, it is possible to discuss what might be the best approach. For instance, at the Archon Congress in 2023, there was a discussion about the literature that is delivered after an excavation. Would it be preferable to have the specialist reports systematically written in English? Does this solve the problem of grey literature or is this a solution that is not compatible with the current archaeological system in the Netherlands? In this regard, a clear division was noticeable amongst those attending, with some pleading for the use of English and others opting for a complete Dutch literature database. To facilitate future research in the aspects mentioned above, a foundation needs to be created first, as well as systematically applied work. In that case, the challenge, of not being able to compare data is no longer an issue. Furthermore, it would seem most interesting in my opinion to include Dog paraphernalia in a research project, in case it is conducted on a larger scale in the future.

Stable nitrogen isotope values can be indicative of the dog's diet and this would make an interesting research opportunity, as a diet is indicative of the care that was provided to the dog when compared to the available resources of the site. The dental decay examination is also not included in this study, but, as described in section 6.8, could potentially provide additional information for the benefit of special dietary needs and/or food provided by caregivers by hand.

ABSTRACT

This master's thesis aims to explore the relationship between humans and dogs during the Roman period around the Dutch Rhine Delta and take a small step towards increasing the current knowledge of how people interacted with and utilised their dogs. To gain further insight into this matter, osteometric data from archaeological dog remains were collected and examined. Additionally, literary records and iconographic sources were examined.

Within research, certain key elements are of great importance, comprising of the functionality of the dog, their morphology, their pathologies and how the dogs were treated. In addition to examining bone material from the dogs included in the research, several factors have been added to the study to gain a better understanding of the relationship between humans and dogs in the Roman period in the Dutch Rhine Delta. It also evaluates variations between the research sites included. An interdisciplinary approach is employed since a combination of historical, archaeological and archaeozoological information is used. This type of research has already been conducted in other countries than the Netherlands, see reference list, but this type of research has not yet been applied in Dutch studies. Other research has proven that the relationship between humans and dogs is more complex than previously thought. In particular, the treatment of dogs at the time of death has resulted in a diversity of observations (Gene, 2018; Grieve, 2012).

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APPENDIX I: MEASURENTS OF THE SKULL FROM LEIDEN ROOMBURG

Cranium dorsal view										
1	**7**	**9**	**8**	**10**	**12**	**29**	**30**	**31**	**32**	**33**
198,7	95,7	111,9	93,6	66,4	81,1	53,6	109,9	38,3	56,6	44,2

Cranium left side view				
1	**9**	**7**	**38**	**39**
198,8	111,6	96	56,2	53,7

Cranium basal view																
2	**3**	**4**	**5**	**13**	**13a**	**14**	**14a**	**15**	**16**	**17**	**22**	**23**	**24**	**34**	**35**	**36**
187,3	177	53	120,6	99,1	95,7	35,7	32,3	62,3	17,8	47	21,1	68,5	64,8	66,4	40,1	40,7

Cranium Nuchel view					
23	**25**	**26**	**27**	**28**	**40**
68,5	38,1	55,4	20,5	14,9	42,7

Maxillary teeth (P4)			**Maxillary teeth (M1)**		**Maxillary teeth (M2)**	
L	**B**	**GB**	**L**	**B**	**L**	**B**
19	7,4	9,9	12,6	15,6	6,6	9,6

APPENDIX II DENTAL WEAR STAGES FROM HORARD-HERBIN (1998).

ZOO_ID	PROJECT	SIDE	Tooth wear
LR_46/5/516	Leiden Roomburg	SIN	Fc
LR_46/5/516	Leiden Roomburg	DEX	Fb
LR_46/5/545	Leiden Roomburg	SIN	Ca
LR_46/5/545	Leiden Roomburg	DEX	Ca

APPENDIX III: ARCHAEOZOOLOGICAL DATA

ZOO_ID	Withers height (CM)	withers heights cat.	type	Background of site	Measured by	Phase	Project	Burial Location	Rituals deposit	IND_NR	ELEMENT	Sex	Age	Age in stages	SIDE
LR_46/5/516_Cr			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Cranium	Male	36	Adult	NA
LR_46/5/516_Man_S			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Mandible	Male	36	Adult	SIN
LR_46/5/516_Man_D			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Mandible	Male	36	Adult	DEX
LR_46/5/516_At			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Atlas	Male	36	Adult	NA
LR_46/5/516_Ax			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Axis	Male	36	Adult	NA
LR_46/5/516_Sca_S			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Scapula	Male	36	Adult	SIN
LR_46/5/516_Sca_D			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Scapula	Male	36	Adult	DEX
LR_46/5/516_Hu_S			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Humerus	Male	36	Adult	SIN
LR_46/5/516_Hu_D			NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Humerus	Male	36	Adult	DEX

LR_46/5/516_RA_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Radius	Male	36	Adult	SIN
LR_46/5/516_RA_D		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Radius	Male	36	Adult	DEX
LR_46/5/516_Ul_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Ulna	Male	36	Adult	SIN
LR_46/5/516_Ul_D		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Ulna	Male	36	Adult	DEX
LR_46/5/516_Fe_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Femur	Male	36	Adult	SIN
LR_46/5/516_Ti_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Tibia	Male	36	Adult	SIN
LR_46/5/516_Met_D		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Metapodials	Male	36	Adult	DEX
LR_46/5/516_Met_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		1	Metapodials	Male	36	Adult	SIN
LR_46/5/516_Met_s		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		2	Metapodials	NA	NA	NA	SIN
LR_46/5/516_Met_s		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		2	Metapodials	NA	NA	NA	SIN
LR_46/5/537_Hu_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		3	Humerus	NA	NA	NA	SIN
LR_46/5/545_Man_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		4	Mandible	Female	6	Puppy	SIN
LR_46/5/545_Man_D		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		4	Mandible	Female	6	Puppy	DEX
LR_46/5/545_Sca_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		4	Scapula	Female	6	Puppy	SIN
LR_46/5/545_Hu_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		4	Humerus	Female	6	Puppy	SIN
LR_46/5/545_Hu_D		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		4	Humerus	Female	6	Puppy	DEX
LR_46/5/545_Ra_S		NA	military/civilian	self-measured		Leiden Roomburg	Unknown		4	Radius	Female	6	Puppy	SIN

LR_46/5/545_Ra_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Radius	Female	6	Puppy	DEX
LR_46/5/545_Ul_S			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Ulna	Female	6	Puppy	SIN
LR_46/5/545_Ul_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Ulna	Female	6	Puppy	DEX
LR_46/5/545_Fe_S			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Femur	Female	6	Puppy	SIN
LR_46/5/545_Fe_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Femur	Female	6	Puppy	DEX
LR_46/5/545_Ti_S			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Tibia	Female	6	Puppy	SIN
LR_46/5/545_Ti_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Tibia	Female	6	Puppy	DEX
LR_46/5/545_Fi_S			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Fibula	Female	6	Puppy	SIN
LR_46/5/545_Fi_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Fibula	Female	6	Puppy	DEX
LR_46/5/545_Met_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Metapodials	Female	6	Puppy	DEX
LR_46/5/545_Met_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		4	Metapodials	Female	6	Puppy	DEX
LR_46/5/545_Fe_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		5	Femur	NA	NA	NA	DEX
LR_46/5/514_Fe_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		6	Femur	NA	NA	NA	DEX
LR_46/5/514_Ti_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		6	Tibia	NA	NA	NA	DEX
LR_46/5/514_Met_S			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		6	Metapodials	NA	NA	NA	SIN
LR_46/5/514_Met_D			NA	military/ civilian	self-measured		Leiden Roomburg	Unknown		6	Metapodials	NA	NA	NA	DEX
LR_11/5/96_Man_S			NA	military/	self-measured		Leiden Roomburg	Unknown		7	Mandible	NA	NA	NA	SIN

				civilian											
AadR_2/2/5/1_Ul_D			NA	military	self-measured		Alphen aan de rijn	Unknown		9	Ulna	NA	NA	NA	DEX
Spijk_17/07_Hu			NA	civilian	self-measured		Spijkernisse	Burn site	yes	10	Humerus	NA	NA	NA	NA
Spijk_17/07_Man_D			NA	civilian	self-measured		Spijkernisse	Burn site	yes	11	Mandible	NA	NA	NA	DEX
Hoog_521_Fe_D	41,1	40-42	Medium dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		12	Femur	NA	18	Juvenile	DEX
Hoog_175_Met_D			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		13	Metapodials	NA	18	Juvenile	DEX
Hoog_517_Met_D			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		14	Metapodials	NA	18	Juvenile	DEX
Hoog_154_Met_S			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		15	Metapodials	NA	18	Juvenile	SIN
Hoog_525_Met_D			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		16	Metapodials	NA	18	Juvenile	DEX
Hoog_396_Met_D			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		17	Metapodials	NA	18	Juvenile	DEX
Hoog_520_Hum_D	41,6	41-42	Medium dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		18	Humerus	NA	18	Juvenile	DEX
Hoog_521_Rad_S	32,8	32-33	Small dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		19	Radius	NA	18	Juvenile	SIN
Hoog_533_Ul_D	34,8	34-35	Small dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		20	Ulna	NA	18	Juvenile	DEX
Hoog_611_Ul_S	51,8	51-52	Medium dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		21	Ulna	NA	18	Juvenile	SIN
Hoog_611_Fe_D	61,8	61-62	Big dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		21	Femur	NA	18	Juvenile	DEX
Hoog_1165_Hu_D	62,2	62-63	Big dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		22	Humerus	NA	18	Juvenile	DEX
Hoog_1447_Met_D			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		23	Metapodials	NA	18	Juvenile	DEX
Hoog_959_Met_D			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		24	Metapodials	NA	18	Juvenile	DEX
Hoog_1161_Ra_D	57,9	57-58	Medium dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		25	Radius	NA	18	Juvenile	DEX
Hoog_1343_Met_S			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch		26	Metapodials	NA	18	Juvenile	SIN

Hoog_1292_Met_S			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch	27	Metapodials	NA	18	Juvenile	SIN
Hoog_1292_Fe_S	61,8	61-62	Big dog	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch	27	Femur	NA	18	Juvenile	SIN
Hoog_1292_Fe_D			NA	civilian	self-measured	Fase 1	Vlaardingen	creek floor/Ditch	27	Femur	NA	18	Juvenile	DEX
Self-measured to this point														
SCH_FI	27	26-27	Small dog	military	Drawn from literature		Den haag	Unknown	28	Fibula	NA	NA	NA	NA
SCH_TI	28	27-28	Small dog	military	Drawn from literature		Den haag	Unknown	29	Tibia	NA	NA	NA	NA
SCH_FE	31	30-31	Small dog	military	Drawn from literature		Den haag	Unknown	30	Femur	NA	NA	NA	NA
SCH_FI	30	29-30	Small dog	military	Drawn from literature		Den haag	Unknown	31	Fibula	NA	NA	NA	NA
SCH_TI	69	68-69	Big dog	military	Drawn from literature		Den haag	Unknown	32	Tibia	NA	NA	NA	NA
Hoog-extra_Cra_1			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Cranium	NA	18	Juvenile	NA
Hoog-extra_Cra_2			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Cranium	NA	18	Juvenile	NA
Hoog-extra_man_1			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Mandible	NA	18	Juvenile	NA
Hoog-extra_man_2			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Mandible	NA	18	Juvenile	NA
Hoog-extra_man_3			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Mandible	NA	18	Juvenile	NA
Hoog-extra_man_4			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Mandible	NA	18	Juvenile	NA
Hoog-extra_man_5			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Mandible	NA	18	Juvenile	NA
Hoog-extra_verti_C			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch		Vertibae	NA	18	Juvenile	NA

Hoog-extra_verti_C			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Vertibae	NA	18	Juvenile	NA
Hoog-extra_Axis_1			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Axis	NA	18	Juvenile	NA
Hoog-extra_Axis_2			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Axis	NA	18	Juvenile	NA
Hoog-extra_hum_1			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Humerus	NA	18	Juvenile	NA
Hoog-extra_hum_2			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Humerus	NA	18	Juvenile	NA
Hoog-extra_radius_1			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Radius	NA	18	Juvenile	NA
Hoog-extra_radius_2			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Radius	NA	18	Juvenile	NA
Hoog-extra_radius_3			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Radius	NA	18	Juvenile	NA
Hoog-extra_Ulna_1			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Ulna	NA	18	Juvenile	NA
Hoog-extra_Ulna_2			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Ulna	NA	18	Juvenile	NA
Hoog-extra_pel			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Pelvis	NA	18	Juvenile	NA
Hoog-extra_Fem			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Femur	NA	18	Juvenile	NA
Hoog-extra_Tib_1			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Tibia	NA	18	Juvenile	NA
Hoog-extra_Tib_2			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Tibia	NA	18	Juvenile	NA
Hoog-extra_cal			NA	civilian	Drawn from literature	Fase 1	Vlaardingen	creek floor/Ditch			Calcanium	NA	18	Juvenile	NA
Hoog-extra_man_1			NA	civilian	Drawn from literature	Fase 1/2	Vlaardingen	creekfill			Mandible	NA	18	Juvenile	NA
Hoog-extra_man_2			NA	civilian	Drawn from literature	Fase 1/2	Vlaardingen	creekfill			Mandible	NA	18	Juvenile	NA

Hoog-extra_verti_Lu			NA	civilian	Drawn from literature	Fase 1/2	Vlaardingen	creekfill			Vertibae	NA	18	Juvenile	NA
Hoog-extra_Hum_1			NA	civilian	Drawn from literature	Fase 1/2	Vlaardingen	creekfill			Humerus	NA	18	Juvenile	NA
Hoog-extra_Hum_2			NA	civilian	Drawn from literature	Fase 1/2	Vlaardingen	creekfill			Humerus	NA	18	Juvenile	NA
Hoog-extra_Rad			NA	civilian	Drawn from literature	Fase 1/2	Vlaardingen	creekfill			Radius	NA	18	Juvenile	NA
Hoog-extra_meta			NA	civilian	Drawn from literature	Fase 1/2	Vlaardingen	creekfill			Metapodials	NA	18	Juvenile	NA
Hoog-extra_cra_1			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Cranium	NA	18	Juvenile	NA
Hoog-extra_cra_2			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Cranium	NA	18	Juvenile	NA
Hoog-extra_cra_3			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Cranium	NA	18	Juvenile	NA
Hoog-extra_cra_4			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Cranium	NA	18	Juvenile	NA
Hoog-extra_man_1			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Mandible	NA	18	Juvenile	NA
Hoog-extra_man_2			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Mandible	NA	18	Juvenile	NA
Hoog-extra_man_3			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Mandible	NA	18	Juvenile	NA
Hoog-extra_man_4			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Mandible	NA	18	Juvenile	NA
Hoog-extra_verti_C			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Vertibae	NA	18	Juvenile	NA
Hoog-extra_scap			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Scapula	NA	18	Juvenile	NA
Hoog-extra_Rad_1			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Radius	NA	18	Juvenile	NA
Hoog-extra_pel			NA	civilian	Drawn from	Fase 2	Vlaardingen	Dam structures			Pelvis	NA	18	Juvenile	NA

					literature										
Hoog-extra_fem_1			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Femur	NA	18	Juvenile	NA
Hoog-extra_fem_2			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Femur	NA	18	Juvenile	NA
Hoog-extra_pat			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Patella	NA	18	Juvenile	NA
Hoog-extra_ti			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Tibia	NA	18	Juvenile	NA
Hoog-extra_meta			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures			Metapodials	NA	18	Juvenile	NA
Hoog_396_Met_D			NA	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures		33	Metapodials	NA	18	Juvenile	DEX
Hoog_1803_Fe_D	63	62-63	Big dog	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures		34	Femur	NA	18	Juvenile	DEX
Hoog_2350_Fe_S	34,4	34-35	Small dog	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures		35	Femur	NA	18	Juvenile	SIN
Hoog_1705_Ra_D	43,3	43-44	Medium dog	civilian	Drawn from literature	Fase 2	Vlaardingen	Dam structures		36	Radius	NA	18	Juvenile	DEX
Hoog_2369_Ra_S	30,7	30-31	Small dog	civilian	Drawn from literature	Fase 3	Vlaardingen	Dam structures		37	Radius	NA	18	Juvenile	SIN
178.105			NA	civilian	Drawn from literature	Phase 2	Tiel-passewaaij	Ditch		38	Cranium	NA	24	Adult	NA
122.308/1	56,7	56-57	Medium dog	civilian	Drawn from literature	Phase 2	Tiel-passewaaij	Unknown		39	Tibia	NA	NA	NA	DEX
839/133	64,7	64-65	Big dog	civilian	Drawn from literature	Phase 3	Tiel-passewaaij	Unknown		40	Femur	NA	NA	NA	NA
839/132	62,3	62-63	Big dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Unknown		40	Tibia	NA	NA	NA	NA
216.146			NA	civilian	Drawn from literature	Tiel-passewaaij	Unknown		41	Cranium	NA	24	Adult	NA	
188.181/1	33,5	33-34	Small dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	42	Humerus	NA	24	Adult	DEX

188.181/2	34,7	34-35	Small dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	43	Femur	NA	24	Adult	SIN
188.094/1	28	27-28	Small dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	44	Radius	NA	24	Adult	DEX
188.164/3	45,7	45-46	Medium dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	45	Humerus	NA	24	Adult	SIN
188.164/4	45,4	45-46	Medium dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	45	Humerus	NA	24	Adult	DEX
188.164/8	47,1	47-48	Medium dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	46	Femur	NA	24	Adult	DEX
188.164/10	45,6	45-46	Medium dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	45	Tibia	NA	24	Adult	NA
36.252	54,6	54-55	Medium dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Unknown		47	Humerus	NA	NA	NA	SIN
36.252	57	56-57	Medium dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Unknown		47	Radius	NA	NA	NA	DEX
36.252	57,1	57-58	Medium dog	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Unknown		47	Femur	NA	NA	NA	DEX
188.219			NA	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Pit	Yes	48	Complete skeleton	NA	7	Juvenile	NA
122.289			NA	civilian	Drawn from literature	Phase 3	Tiel-passewaaij	Ditch		49	Cranium	NA	24	Adult	NA
163.765			NA	civilian	Drawn from literature	Phase 3	Tiel-passewaaij	Ditch		50	Cranium	NA	24	Adult	NA
122.454/1	57,7	57-58	Medium dog	civilian	Drawn from literature	Phase 5-6	Tiel-passewaaij	Unknown		51	Femur	NA	NA	NA	SIN
122.418/2	73,5	73-74	Big dog	civilian	Drawn from literature	Phase 3-4	Tiel-passewaaij	Ditch	Yes	52	Humerus	Male	24	Adult	DEX
122.418/1	72,8	72-73	Big dog	civilian	Drawn from literature	Phase 3-4	Tiel-passewaaij	Ditch	Yes	52	Humerus	Male	24	Adult	SIN
122.418/3	72,5	72-73	Big dog	civilian	Drawn from literature	Phase 3-4	Tiel-passewaaij	Ditch	Yes	52	Radius	Male	24	Adult	SIN
122.418/4	72	72-73	Big dog	civilian	Drawn from	Phase 3-4	Tiel-passewaaij	Ditch	Yes	52	Ulna	Male	24	Adult	SIN

	,1				literature										
122.418/5	76,6	76-77	Big dog	civilian	Drawn from literature	Phase 3-4	Tiel-passewaaij	Ditch	Yes	52	Femur	Male	24	Adult	SIN
22.418/6	73,4	73-74	Big dog	civilian	Drawn from literature	Phase 3-4	Tiel-passewaaij	Ditch	Yes	52	Tibia	Male	24	Adult	SIN
163.613			NA	civilian	Drawn from literature	Phase 4	Tiel-passewaaij	Ditch	Yes	53	Cranium	NA	24	Adult	NA
122.305/1	66,3	66-67	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	54	Humerus	Male	24	Adult	SIN
122.305/2	66,6	66-67	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	54	Humerus	Male	24	Adult	DEX
122.305/3	62,4	62-63	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Radius	Male	24	Adult	SIN
122.305/4	62,7	62-63	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Radius	Male	24	Adult	DEX
122.305/5	62,1	62-63	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Ulna	Male	24	Adult	SIN
122.305/6	62,9	62-63	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Ulna	Male	24	Adult	DEX
122.305/7	64	63-64	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Femur	Male	24	Adult	SIN
122.305/8	64,3	64-65	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Femur	Male	24	Adult	DEX
122.305/9	62,3	62-63	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Tibia	Male	24	Adult	SIN
122.305/10	62	61-62	Big dog	civilian	Drawn from literature	Phase 4-5	Tiel-passewaaij	Ditch	Yes	55	Tibia	Male	24	Adult	DEX
179.174			NA	civilian	Drawn from literature	Phase 5	Tiel-passewaaij	Ditch	Yes	56	Cranium	NA	24	Adult	NA
179.169			NA	civilian	Drawn from literature	Phase 5	Tiel-passewaaij	Ditch	Yes	56	Mandible	NA	24	Adult	NA
165.152	55.2	55-56	Medium dog	civilian	Drawn from literature	Phase 5	Tiel-passewaaij	Well		57	Complete skeleton	NA	24	Adult	NA

165.161	55.2	55-56	Medium dog	civilian	Drawn from literature	Phase 5	Tiel-passewaaij	Well		58	Complete skeleton	NA	24	Adult	NA
125.002/6	29,9	29-30	Small dog	civilian	Drawn from literature	Phase 5-6	Tiel-passewaaij	Pit	Yes	59	Humerus	NA	24	Adult	SIN
125.002/11	32	31-32	Small dog	civilian	Drawn from literature	Phase 5-6	Tiel-passewaaij	Pit	Yes	59	Femur	NA	24	Adult	DEX
125.002/14	27,4	27-28	Small dog	civilian	Drawn from literature	Phase 5-6	Tiel-passewaaij	Pit	Yes	59	Tibia	NA	24	Adult	SIN
196.078/6	54,6	54-55	Medium dog	civilian	Drawn from literature	Phase 5-6	Tiel-passewaaij	House ditch	Yes	60	Humerus	NA	24	Adult	SIN
196.078/9	56	55-56	Medium dog	civilian	Drawn from literature	Phase 5-6	Tiel-passewaaij	House ditch	Yes	60	Humerus	NA	24	Adult	DEX
197.067		small dog	NA	civilian	Drawn from literature	Phase 6	Tiel-passewaaij	House ditch	Yes	61	Complete skeleton	NA	10	Juvenile	NA
166.073			NA	civilian	Drawn from literature	Phase 7	Tiel-passewaaij	Ditch		62	Cranium	NA	NA	NA	NA
165.150/32	60,1	60-61	Big dog	civilian	Drawn from literature	Phase 7	Tiel-passewaaij	Ditch	Yes	63	Humerus	Male	24	Adult	SIN
165.150/33	60,5	60-61	Big dog	civilian	Drawn from literature	Phase 7	Tiel-passewaaij	Ditch	Yes	63	Radius	Male	24	Adult	SIN
165.150/34	60,1	60-61	Big dog	civilian	Drawn from literature	Phase 7	Tiel-passewaaij	Ditch	Yes	63	Ulna	Male	24	Adult	SIN
165.150/25	60,2	60-61	Big dog	civilian	Drawn from literature	Phase 7	Tiel-passewaaij	Ditch	Yes	63	Femur	Male	24	Adult	SIN
165.150/27	60,8	60-61	Big dog	civilian	Drawn from literature	Phase 7	Tiel-passewaaij	Ditch	Yes	63	Tibia	Male	24	Adult	SIN

This master's thesis aims to explore the relationship between humans and dogs during the Roman period around the Dutch Rhine Delta and take a small step towards increasing the current knowledge of how people interacted with and utilised their dogs. To gain further insight into this matter, osteometric data from archaeological dog remains were collected and examined. Additionally, literary records and iconographic sources were examined.

Within research, certain key elements are of great importance, comprising of the functionality of the dog, their morphology, their pathologies and how the dogs were treated. In addition to examining bone material from the dogs included in the research, several factors have been added to the study to gain a better understanding of the relationship between humans and dogs in the Roman period in the Dutch Rhine Delta. It also evaluates variations between the research sites included. An interdisciplinary approach is employed since a combination of historical, archaeological and archaeozoological information is used. This type of research has already been conducted in other countries than the Netherlands, see reference list, but this type of research has not yet been applied in Dutch studies.