A Dog's Life:
An Interdisciplinary Study of Human-Animal Relationships in Roman Britain

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Abstract

Dogs were a key animal in the Roman Empire, appearing in numerous texts, art and artefacts. Newly conquered provinces were affected by this enthusiasm, showing abrupt change in the types of dogs kept, with 'dwarf' dogs appearing for the first time (Bartosiewicz 2010; Colominas 2016). How underlying attitudes changed is a question that has been asked of other aspects of provincial Roman life. This includes new rituals, buildings and diets (King 1999b; 2001; Mattingly 2011: 223-228), but rarely interactions with live animals, despite their capacity to influence human society.

Previous study examined single burials, selected only one attribute for study (Baxter 2006; Clark 1995; Harcourt 1974; MacKinnon and Belanger 2006), or were limited by poor recording in published reports (MacKinnon 2010a). To avoid this problem, I chose 85 skeletons from Iron Age and Roman Britain to analyse directly. A purpose-built 'biography' system brought several types of analysis, including pathology, together to track the lives and deaths of each dog. I also collected a background dataset from published reports and databases.

Universally found across Britain, only a slight preference for canines was found on Southern, urban and military sites. The skeletal evidence indicated that traumatic and age-related lesions were equally common before and after the Conquest of AD43, suggesting continuity in how dogs were treated day-to-day. Yet congenital conditions, such as dwarfism and dental crowding, rose dramatically during the Roman occupation. New genetic stock was likely imported into Britain.

Exploring these skeletons as individual biographies revealed the stories of dogs that were abused, cared for, and changed the lives of the humans around them. Ultimately, dogs have been an excellent 'case animal' to map cultural transformation in Roman Britain, and an indicator of where old ideas prevailed despite new dogs. Or perhaps the conquerors and conquered were not so different in this regard.

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Contents

Appendices

List of Tables

List of Figures

Chapter 1: Opening the Box

1.1. From Archive to Biography

We find animals a constant source of fascination. From bird-watchers, waiting hours for a glimpse of a rare species, to the people who asked me if the Romans kept dogs as pets, they are a huge part of our lives. They shape the way we think about ourselves, the ways we live and the ways we act. But they seem to be minor characters in most broad depictions of the past, barring a glimpse into what people ate or an occasional find of an animal skeleton. The latter is often pored over and reported excitedly to others for a short while, until interest passes and it is put away in a dusty archive. Once reported on, and stored in the archive, material is often forgotten. This happens even in Britain where material is generally recorded and curated well.

Animal skeletons, or even parts of them, are limited by their rarity. Most animals were eaten, and the most obvious exceptions in many periods, horses, were usually found in pieces by excavators, perhaps due to the difficulty in burying them. A whole horse is a fortunate find indeed. But as with many rules, exceptions exist, and there is one animal that was rarely eaten in Europe, but was small enough to bury whole: dogs. Dogs have been by the side of humans for at least 15000 years, and at least 6000 years in the British Isles alone (Harcourt 1974; Larson *et al.* 2012: 8882). This time spans many human transitions, from the Neolithic to the Bronze Age, the Late Medieval to the Early Modern period. These shifts may not only have affected how people lived and the material culture they used, but how they thought about and treated animals. One transition stands out for its sheer quantity of burials, dramatic nature and cultural clashes: the invasion of Iron Age Britain by the Romans. During this time, Britain changed from a series of tribal confederations and kingdoms, to a Roman province and many new animals and plants were brought over to Britain (Albarella *et al.* 2008: 1844; Sykes *et al.* 2006; Lodwick 2017; Van der Veen *et al.* 2008; Van der Veen 2014: 10). The animals people ate also changed.

The bones are not the only forms of evidence to consider animals. The classical world has a valuable legacy of textual sources that survive today. Even though these texts have drawbacks for the historian, being largely written by and for an elite audience, they add valuable insights and a richness to our material that is unique to written material. Art and iconography are also common, depicting a vast array of animals and plants that existed at the time. The few studies of dog bones in Britain hint at an equally dramatic change: new varieties of dog began to appear in very Late Iron Age, and the number only grew post-Conquest (Baxter 2010; Baxter and Nussbaumer 2009; Clark, 1995; Harcourt 1974). Although Morris' work provides an excellent overview of how associated groups of bones, often whole or partial skeletons, changed through time and space numerically (2011), no large-scale analysis of the material themselves has been attempted despite the richness of the material. Yet the lives of an entire dog population changed, and how human cultural ideas and attitudes towards them shifted during Britain's time as a Roman province.

To find these dogs ourselves, we need to return to archives. Cold, damp, and full of obscure material, but also huge potential. There is a continual battle, fought in small collections and archives all through Britain, to stop these priceless (if unglamorous) materials from being thrown away to save on money or archive space. Many valuable remains have already been lost, and many more are under threat. Ralph Harcourt found in the 1970s, much to his chagrin, that five dog skeletons from a settlement in Asthall, Oxfordshire had already been thrown away before he could study them (1974: 164). Even dogs that were noted in a report may have been disposed of, or lost.

My own visit to find these animals served to show the need for more study, while the collections are still available. The Winchester and Dorchester archives (see Fig. 1.1), with perhaps the most Iron Age and Roman dogs in the country, showed this. Every box opened was a surprise. Most contained a unique mix of various animals that ended up in a pit: some giant cattle limbs, or small teeth from a lamb. But every now and then, something a little more promising was found. A couple of bones that looked distinctly canine, or a sharp, delicate tooth of a carnivore. Some contained parts of dog skeletons, with entire limbs and body parts bagged together. The turning point was the box marked 'dog', piquing my curiosity: surely it must have been something interesting? Lifting it from the shelf, I placed it on one of the steps and pulled off the lid. Lying there was the most perfect little dog I had ever seen: every bone was as intact and well-preserved as when it had walked, and even the skull was flawless, even though it was so delicate the light passed through in places.

Fig. 1.1. Searching the archives.

As I write, this dog is sitting on my lab desk, with 84 others of varying states of preservation. They sit in trays, sorted by bone type: skulls and mandibles on one, long bones like the femur and humerus on another, all the small bones on another one. In this instance, so many bones were preserved that the trays are close to overflowing with nearly every bone in the skeleton. Even the baculum (penile bone), which confirms without a doubt that the dog is male. But how do we study an animal like this? Many recording systems in zooarchaeology are designed for individual elements (Dobney and Rielly 1988; Harland *et al.* 2003; Klein and Cruz-Uribe 1984; Vann and Thomas 2006). When individual skeletons are analysed, the methods are usually based on the analysts' interests and the animal's characteristics (cf. Baxter 2006; Tourigny 2016). There is no formal system available for many animals. Yet recording each individual element as a completely separate entity would make it hard to consider this dog as, essentially, a biography of the live animal.

What if we create a biography system, something that can be applied to many different skeletons? If we do this to our erstwhile friend, the results are very interesting indeed. The bones suggest many things. This dog had all of its bones fused, so I was sure it was an adult. But the teeth were hardly worn, so it was probably a young adult. By measuring a long bone and applying a formula (Harcourt 1974: 154), we can work out the general size and build of the dog. This dog was 28cm high and fairly slender: potentially of a small ancient type of similar size and build to a toy poodle.

Many older dogs develop arthritis, or a broken bone heals badly or gets infected. Some dogs likely suffered, some quite a lot. The saddest case I read was a dog that sustained such a wound to its leg, which had become infected and spread through the body, probably killing it (Stallibrass 1996: 608). But this case was more of a mystery: our dog died when it was a young adult, in seemingly perfect health. I knew that. But there was still so much more I did not know. How did it die? Many diseases affect the soft tissue and then spread to the bone, which we can see traces of, but more diseases are invisible than not. Maybe more importantly, *why* did it die? We like to think of dogs in the past, particularly if they were small and endearing, as being treasured pets and we do see many cases in Roman art and literature where a dog was highly valued and loved. But not all were. Rome was full of strays: the Roman author Livy recorded an ominous omen where all the city's strays gathered outside the Pontifex Maximus' residence and howled (Obseq. 710). Although domestic animals were the usual choice, dogs were known to have been offered for sacrifice (Grossi Mazzorin 2006; Wilkens 2006).

Thus, I can say this: this was a rather small young adult when it died, a male dog, and did not appear to have been physically abused or starved during its life, or suffered any serious accidents. But beyond that? What about the other 84? To understand the whole group, many different bones and skeletons need to be analysed together, along with some other evidence. This project is an endeavour to 'open the box' in less literal terms, and understand the roles these dogs played in the Iron Age and Roman transition in Britain, against a backdrop of published faunal work and classical scholarship.

1.2. Research Questions, Aims and Objectives

My key research question is: how did human-dog relationships change across Britain from the Iron Age through to the end of the Roman occupation? Given this is a broad question, I have chosen five specific aims to narrow it down:

A1) *(Time)* Examine how social relationships with dogs changed from the Iron Age through the Roman occupation of Britain.

Where: Chapter 4 and 8.2.

A2) *(Space)*: Investigate variation in social relationships with dogs across regions and different types of settlement.

Where: Chapter 5 and 8.2.

A3) *(Welfare)*: Explore continuity and change in the physical welfare of dogs between Iron Age and Roman Britain.

Where: Chapter 6 and 7.2.

A4) *(Identity)*: Consider if discrepant identities and experience in Britain (defined as a lack of uniform response to Roman imperialism) were expressed through changing relationships with dogs.

Where: Chapter 8.

A5) *(Biographies)*: Explore how animal biographies can be used to investigate human-dog relationships.

Where: Chapters 3, 7 and 8.2.

Even these aims could be explored in many ways. The archaeological evidence is very rich, and includes animal bones, site reports, classical texts, material culture, artistic depictions and even molecular methods such as stable isotope and ancient DNA analysis. To narrow down the scope even further, and create a realistic project for the time frame, I have identified five objectives:

O1) Devise a system for recording dogs as discrete biographies, drawing together a number of recorded attributes (e.g. age, sex, metrics, pathology; see Chapter 3) to consider the life and death of each individual animal (A3, A5).

O2) Examine and record c.80 individual dogs spanning from the Iron Age to the Late Roman period in south-east England using the developed system (A1, A3, A5).

O3) Undertake a focused analysis of pathology on each dog, comparing its prevalence, type and cause (aetiology) between Iron Age and Roman populations (A1, A3).

O4) Supplement the primary evidence with a database of dog faunal data from across England, spanning the Iron Age and Roman periods. This includes the number of identified specimens (NISP), and the numbers of *individual* dogs found as more than one bone in association (see 3.1.1). Analyse regional and temporal differences using statistical analysis (A1, A2, A4).

O5) Analyse select texts from the Late Roman Republic onwards that discuss dogs or attitudes towards animals in general (A1, A4).

1.3. Within the Box

The first step in this project is to consider past research in Chapter 2. Although I referred to a small number of studies on Iron Age and Roman dogs, research into canines as a whole spans a century, many different time periods and geographical locations. There are many lessons to be learned from these works: potential methodologies, theoretical approaches and, most importantly, research gaps to be addressed. Animal research is a multidisciplinary field, including archaeology, history and human-animal studies. From reviewing these areas, a theoretical approach may be established.

Influenced by the previous chapters, I will outline the materials and methods selected in Chapter 3. Materials consist of two types of bone data and a small number of classical texts; the first bone data is the primary material, gained mainly from archives in the South of England. The second is secondary data on dogs, drawn from published reports and databases. I will draw from a suite of methods to analyse both: zooarchaeological methods to measure age, key metrics, pathology and other attributes, and statistical testing for the latter.

Once methods and materials are selected, the process of analysing the results will occupy Chapters 4-7. I will begin with the most overarching question: how the frequency of dogs changed through time. This is to be primarily addressed using secondary data to compare dog Number of Identified Specimens (NISP) and Associated Bone Group (ABG) numbers. The former is a standardised count used in zooarchaeological reports, and is a basic tally of how many bones were identified to a species (Reitz and Wing 2008: 202-203). The latter, a more recent development, was developed by Morris to describe groups of bones that came from a single animal and deposited together (Morris 2011: 12-13). This is a more precise term than 'skeleton', and more valuable for describing dog burials that were affected by taphonomic processes after burial. I will discuss the origins of the term in more detail in Chapter 2, and technical details of the term more thoroughly in Chapter 3.

Primary data and texts shall feature as well, discussing the role of Britannia in the Roman dog trade. But looking at how dog numbers changed *across* Britain is also important, and to be focused on in the following chapter. Similar methods are used to Chapter 4, including quantitative and textual analysis.

Next comes a detailed look at dog health and welfare, using the 85 dog specimens. The types of pathology they had, and where on the skeleton it was found, are first to be discussed. Then I will consider the possible causes for each lesion, and how it may relate to the lives of the animals as a group, in terms of work-related injury, abuse, ageing and congenital disorders. Ten dogs will be selected in Chapter 7 to create detailed biographies and think about how studying animals as individuals can enhance understanding of their interactions with humans.

Finally, all the results need to be brought together in Chapter 8 to answer the more abstract questions of human-dog relationships and how they relate to discrepant identity (see A4). I then close the project by reflecting on the main conclusions, and thinking about how further research could be undertaken.

Chapter 2: The Story of Ancient Dog Research

Dogs, in contrast to many other domestic animals, face unique issues in how they are treated and deposited after death; a higher proportion are found as whole or partial burials than other animals (Appendix E; Morris 2011: 69). Considering how they have been approached by researchers in the past century is essential. Many current limitations of the scholarship on dogs also have their roots in earlier approaches, and in identifying these trends, I can select useful approaches and note gaps that need remedying. The most direct technical applications of this literature will be outlined in Chapter 3 in the methods section, where I discuss which analytical methods I used and why. This review concerns more the types of approaches and broad themes.

As the project overlaps with wider themes in Roman archaeology, history (and the emergent field of human-animal studies), current research in these fields needs reviewing briefly to help shape the project and guide how results will be interpreted nearer the end. There are also theoretical considerations to be made. The methods I choose, and how I interpret the result, will be driven by the theoretical 'backbone' of the thesis. These fields all contain useful perspectives for fleshing out where this project sits in terms of wider themes.

2.1. The Past: Zooarchaeology and Dog Research Across a Century

2.1.1. Observing and Describing Dog Remains (1900-1970)

The very earliest archaeological studies of dogs were highly descriptive and undertaken by veterinary scientists. The earliest treatment of the subject was a 1911 review of canid skulls found at the Roman fort of Newstead, Scottish Borders. This review analysed 13 skulls (12 of which were domestic dogs) and described their main physical characteristics, such as cranium shape and sagittal crest development. Analogies to modern breeds were drawn and the skulls were classified into five varieties or breeds of dogs (Linton 1911). While the attention paid to the physical variation in the skull is detailed, the approach was unsystematic and no rationale for grouping the dogs was provided, nor were any further implications of this revelation discussed.

Archaeological site reports published during this period gave scarce information about animal bones generally and much less about dogs specifically. Harcourt (1974: 164) comments that of 50 Roman sites known to have canid material, only three published any detailed information about the remains. Other works on dogs throughout the first half of the 20th century comprise anatomical reports (Seoudi 1948; Sisson 1914), which were more systematic in nature than the archaeological reports but written for veterinarians.

Only in the final decade of this period, from 1960 to 1970, did works analysing dogs increase in frequency. These studies focused on various aspects of dog physiology that allowed for archaeological application (such as ageing using epiphyseal fusion and dental eruption; Silver 1963; Sumner-Smith 1966), although they were still produced by veterinarians and not archaeologists. As such, they did not consider any wider implications for archaeology or specific challenges archaeologists may face in applying the methods described.

2.1.2. Commercial Zooarchaeology and Morphometrics (1970-1990)

From the 1970s, zooarchaeology began to form a consistent part of commercial archaeological reports. However, dogs were considered alongside other animals, and lacked specific discussion or consideration of individual animals, so little information could be gleaned beyond bone counts and perhaps approximate size and shape. Pathology was not often recorded: when it was, it was rarely dealt with systematically. Usually, an 'interesting specimen' (cf. Thomas and Mainland 2005: 2) may have been described. This growing importance of zooarchaeology in archaeology led to a major change in publication; many zooarchaeological papers, both within and outside commercial reports, were increasingly written by archaeologists in this period onwards (Burleigh *et al.* 1977; Harcourt 1974; Teichert 1987).

Dedicated studies on dogs mostly emphasised metric analysis during this time. These were often very thorough and used methods that are still used now for estimating dog size. Key examples of these studies comprise Harcourt's work on dogs in prehistoric and early historic Britain; in this paper he proposed a method for calculating dog height at withers using the long bones (1974: 154). Burleigh *et al.*'s work on Neolithic dog burials (1977) was impressively detailed; extensive measurements were taken, radiocarbon dating was used and even the contents of the dogs' stomach at the time of death were assessed. On the other hand, both contained very little discussion on dogs beyond their size or shape and how this changed through time. Dogs were not considered in terms of their roles, cultural significance or what they meant to their owners.

Other key advances in method originate from this period, such as sexing of dogs (The and Trouth 1976; Trouth *et al.* 1977). However, these studies were strongly influenced by processual archaeology and they do not consider the wider implications of the advances in terms of what may be interpreted from sexing dog remains. More broadly, the influence of processual archaeology was apparent from the frequency of publication of methodological papers, with little interpretation, at this time.

Later on in this period, dogs began to be considered beyond their physical characteristics: Teichert (1987) considered the physiology of small dogs within the Roman Northern Alps and proceeded further than previous works to consider the reasons for their appearance. While the keeping of these small dogs as luxury pets was discussed, the work did not progress to more considered discussion of the relationships between these small dogs and people.

2.1.3. The Influence of Post-Processual Archaeology (1990-2000)

Post-processual archaeology began to exert influence on zooarchaeology from the early 1990s, and the research questions studies asked began to change accordingly. From an abundance of papers that explored methodological issues in zooarchaeology, research increasingly asked about the ways animal bones reflected on key aspects of the human experience: identity, ritual and broader human action. While most of this work concerned animals largely kept for food and secondary products, such as cattle and pigs, this influence is apparent in works on dogs too.

At the beginning of 2000, a key text was published, entitled *Dogs Through Time: An Archaeological Perspective* (Crockford 2000). This edited volume, reflects this changing perspective on dogs. Topics covered included dogs in ritual practice (Grossi Mazzorin and Tagliacozzo 2000), how the types kept reflected human identity (Bartosiewicz 2000) and the quotidian roles they may have played (Olsen 2000). However, many of the papers still considered morphometrics only, though the approach to these had changed. Bartosiewicz's paper reviewed not only morphological differences in dogs between settlements in the Carpathian Basin, but also how this may relate to wider identity and culture. Dogs may have been larger in rural Sarmatian settlements due to their pastoral way of life, while the site across the river may have kept smaller dogs due to Roman cultural influence (Bartosiewicz 2000: 186, 189). These papers indicate progress in how dogs were regarded, and a greater interest in their roles in human society.

Yet it is still apparent that other forms of zooarchaeological evidence were not being widely explored. Only one study of 29 considered dog pathology and this was limited to a small suite of pathology, namely: fractures, osteoarthritis and vertebral marginal osteophytosis (Warren 2000). This leaves out a considerable amount of other conditions, such as dental pathology, infection, nutritional deficiencies, congenital anomalies and neoplasia. Other papers published outside of the volume shared this issue. Clark's papers examining Neolithic, prehistoric and protohistoric dogs investigated both metrics and pathology, but only a paragraph of information was given in both instances (1995: 17; 1996: 213), meaning that conditions present were discussed but the quantity and distribution were not clarified.

Although archaeological studies were beginning to explore the role of dogs as a means of expressing identity and their use in ritual and daily life, their influence on humans in turn was not considered. The dogs themselves were considered passive agents. For instance, taking the physical capabilities of dogs into account is a crucial step for considering their influence on human attitudes; as Olsen discussed in her paper on Eneolithic dogs, dogs of particular size and stature would have been more or less able to carry out particular actions. A dog like a Samoyed, for instance, would be unable to carry very heavy loads but would have had greater physical stamina (Olsen 2000: 85). Yet what this would mean in terms of the dog's actions and interactions with humans were not explored.

2.1.4. Emergence of Animal Palaeopathology and Interdisciplinary Research (2000-2010)

Twenty years after Baker and Brothwell's key work on animal bone pathology (Baker and Brothwell 1980), the sub-discipline finally began to be seriously considered in zooarchaeology (cf. Thomas 2012). However, work from the turn of the century has tended to focus more on other domesticates, and works on dogs tended to center on a single case study or a small amount of data. What work has been done allows for investigation of the types of pathology dogs would have been affected by, but with limitations. Many focused on fractures (Groot 2008; Teegen 2005) or a limited suite of conditions (Warren 2000).

While the identification and recording of lesions increased greatly in both quantity and quality during this time, interpretation of why the lesions occurred had limited scope. Although other causes for injuries in dogs were considered, such as accidents or human self-defence, the focus of discussion has centred upon 'abuse' (Binois 2013; Murphy 2005; Teegen 2005). This is understandable in part, as abuse is far easier to detect than care (Thomas 2017: 181-182) and simpler to discuss than age-related conditions. However, more discussion of lesion aetiology and why they occurred in terms of human-animal relations, would make better use of the data collected. Other papers discussed the possibility of human care for individual dogs and how this was mediated by their relationship with the animal (MacKinnon and Belanger 2006; Udrescu 2005), but this approach needs to be integrated within larger datasets.

This period also showed a greater interest in osteological analysis, beyond diet, in the classical world. The growth in output in classical osteology has been noted by other authors, and the area has begun to show greater concern for interdisciplinarity (MacKinnon 2007: 478-479, 494-496), owing perhaps to the greater faunal and written evidence available. Through these studies, many themes may be explored further: conquest, acculturation, large-scale trade, and the link between these and interactions with animals. However, this currently focuses more on domesticates exploited for food than integrated studies on dogs (MacKinnon 2001; 2004; 2010b; 2010c).

Research on dog palaeopathology, when combined with greater interest in the ancient world, culminated in perhaps the most relevant study to this thesis, MacKinnon's survey of dogs within the Roman Mediterranean; this examined the pathology of dogs from a large number of sites. However, there are a number of serious limitations that were beyond the author's control; poor recording of pathology on the sites examined resulted in a total of only 13 sites out of 200 in Italy and 10 out of 170 sites in Mediterranean provinces containing suitable data (MacKinnon 2010a: 294-301). This created further limitations in attempting to interpret the data, as the data covered the whole Mediterranean and at least six centuries; trends through time or space became impossible to draw. Key advances were made compared to previous work with smaller datasets. More careful consideration of dog welfare and care were considered (in relation to the past too), and presumptions about abuse were not made (MacKinnon 2010a: 304-305).

While the methodology was, on the whole, excellent and a considerable advance on previous works, there were still a few weaknesses. In the data tables, fragments were mixed in with skeletons and the specific number of individuals were not quantified in several places. While this made for a good summary of the pathology present, it was very difficult to see any quantification of how many dogs had a particular issue and how many did not. While general trends were noted about the most and least prevalent issues and most common body parts affected, this was not quantified (MacKinnon 2010a: 301-302). In essence, this shows a move away from an 'interesting specimens' approach in terms of scale, but that a fully quantitative alternative had yet to be developed; a trait shared by most work in this period. A study within this period that used quantification to a greater degree is Groot's study of pathology in the Roman site of Tiej-Passewaaij in the Netherlands (2008). This study was more explicit in its quantification of pathology, which allowed for analysis by element and comparison with other datasets. However, it was limited by consisting of one dataset only and focusing on fractures.

Work on metrics has continued into the 21st century, but the emphasis shifted slightly to trying to find types of dogs rather than just size, and discussion of their breeding and function (Baxter 2006; Baxter and Nussbaumer 2009; Philips *et al.* 2009). Interestingly, most of these new works spanned the Roman period or its immediate precursors; Baxter

(2006; 2010) examined small dogs in Roman Britain, while Baxter and Nussbaumer used case studies from the latest Iron Age (2009). This may be due to the fact that the period presents two interesting questions about changing morphology: how dog size changed in the Roman world and its provinces, and why. The first question links to wider cultural change, and the latter to both human and dog agency. In this respect, the newer studies were aiming to consider these questions more carefully rather than charting change for its own sake; however, they still considered smaller questions about dog breeding rather than how it links to larger themes such as cultural change in Roman provinces. By contrast, a more recent advance is Colominas' work on dog morphology in the province of Hispania, which integrates palaeopathological analysis and considers how the change in morphology is related to the Roman annexation and subsequent commercial activity (2015).

Methodological advancements were still being made, albeit at a slower rate than during the formative period of zooarchaeology. This work appears to be more theoretically informed, as Ruscillo's study of the 'table test' method of sexing dog humeri considered the implications that development of the humeral tuberosity is affected by levels of physical activity and aggression, which the author acknowledged to be affected by a dog's actions and behaviour (Ruscillo 2006). It is a clear sign of progress that this methodological work also considered, albeit briefly, the agency of dogs.

Overall, while neither consistent nor extensive, signs of major theoretical progress are apparent during this time. Morey's work on the development of human-dog social bonds used the burial of dogs as a basis for considering their relationship in life (Morey 2006). Additionally, two edited volumes were published that emphasised the importance of interdisciplinarity in zooarchaeology. Maltby's *Integrating Zooarchaeology* (2006) consists of papers that integrate zooarchaeology with a diverse range of disciplines: history (Thomas 2006), ethnography (Sasson 2006), architectural analysis (Friesen and Betts 2006) and material culture (Manconi 2006). Snyder and Moore's work focused specifically on dogs, and some of the papers used ethnographic or historical data (Barsh *et al.* 2006; Nobayashi 2006; Trantalidou 2006). However, little of this interdisciplinarity was apparent in works on dogs outside of Snyder's volume and Smith's work on Iron Age and Roman dogs (2006) that drew from zooarchaeology, material culture and iconography. The former comprise small works and the latter used the faunal evidence to a much smaller degree than the material and visual sources, so the need for a larger work that uses bones in equal measure with other disciplines is still apparent.

2.1.5. The Emergence of Social Zooarchaeology and its Relation to Dogs (2010-present)

Over the past eight years, theoretical work on agency (Hodder 2012) has begun to filter into archaeology, considering the idea that agency (the ability to act and influence others) is not only limited to humans. Yet much of this work considers the agency of inanimate objects (e.g. Boast 1997: 190; Robb 2004: 131-132), and others have suggested this be extended to other animate beings (Brown and Walker 2008: 298; Johannsen 2012: 312, 337-339). This challenge is reflected in Russell and Sykes' books where they proposed a new area of zooarchaeology: ‘social zooarchaeology’ (Russell 2012; Sykes 2014: 2). The field proposes to examine how humans and animals interacted with and influenced one another in life. The new area is also influenced by the 'animal turn' in wider humanities; this has rejected anthropocentrism and called for more work in the humanities that does not consider animals as passive beings or extensions of humans (Fudge 2002; 2008; Haraway 2003; 2008).

The term was first used in Marciniak's book (2005), but was used more widely after the publication of Russell's *Social Zooarchaeology* (2012). Social zooarchaeology emerged as a challenge to traditional zooarchaeological approaches which focused on using the remains of animals to reconstruct past diet and economy; it called for a more holistic approach that considers all the ways in which humans and animals interact. Part of this move, is driven by recognition that human-animal interactions are vital sources of information about past societies and cultures (Sykes 2014: 1). This is not a wholly original idea, and one that has been acknowledged by anthropologists and sociologists for some time (e.g. Ingold 2000: 61-76). However, this has been discussed in archaeology only very recently by zooarchaeologists attempting to outline a paradigm for social zooarchaeology (Sykes 2014).

This advance is also reflected in a key theoretical development: the adoption of a biographical approach to animal deposits. This concept originated in Kopytoff's work on the biographies of objects (Kopytoff 1986: 66-68), and was built upon in Morris' work on animal burials. However, Morris focuses more on the animal's death and deposition, and the process of ABG creation after death (Morris 2011: 172-179; Morris 2012: 16-18). If characteristics that the animal displayed during life (e.g. age, pathology, size and shape) are considered alongside its death, then the biography can reveal insights into its relationship with humans, as Tourigny's osteobiography of a 19th century dog from Toronto, Canada shows. The study was able to consider how the dog lived and potentially interacted with humans. Its large size, injuries that would have left it limping and in considerable pain and smelling of a foul odor contrast with its burial in an urban backyard, suggesting that its owners may have kept it as a companion (Tourigny *et al.* 2016: 826-827) and possibly cared for it in its final days. While the study does not discuss how the evidence of the dog's life affected its relationship with humans beyond its potential role, a hunting animal, the osteobiography is valuable as a basis for further discussion.

Despite the fact that people and dogs often live in close proximity, perhaps more so than any other species, these new ideas have not involved dogs specifically to any great degree. Key works have examined wild animals and chickens (Overton and Hamilakis 2013; Sykes 2012), but only a few feature dogs. The first was a small case study by Sykes, which was intended to be part of a general introduction to social zooarchaeology and prompt further work (2014: 141-144). Another was a larger-scale work, which examined human-dog relationships in late Medieval England and Ireland with bone and historical evidence (Grieve 2012). It considered human attitudes towards dogs and their roles, but was less mindful of how dogs influenced humans in turn. More relevant to the classical period and Britain, Bennett and Timm undertook an extensive study of dog morphology on Vindolanda, and considered in great detail the types of canines found and their potential roles (Bennett *et al.* 2016; Bennett and Timm 2016). But biographical analysis or extensive discussion of human-dog relationships on the fort are not the focus.

An issue that has been discussed within social zooarchaeology (Sykes 2014: 17) is that of greater interdisciplinarity. Zooarchaeology may be able to draw the most extensive and interesting conclusions by working with other disciplines, but in the past 10 years this has been limited to historical and ethnographic work (Thomas 2006; Fothergill 2012; Grieve 2012). Historical analysis is clearly valuable and allows zooarchaeologists to draw fuller conclusions on attitudes towards animals, while ethnographic work is useful for considering new ideas and perspectives outside of our own culture. But more areas need to be drawn on. How can we understand animal actions in the past if we do not understand how they think and behave? The only paper that considers this, albeit briefly, is Losey *et al.* 's work on craniomandibular trauma and tooth loss in canids. They discussed the idea that dog injuries may be affected by behaviour and temperament: aggressive dogs potentially being more likely to engage in physical conflict with other dogs and humans (2014: 14). Although more development of this idea and how it would fit within zooarchaeological analysis is needed, it is important to consider.

Ethnography and zooarchaeology were increasingly integrated during this period, as shown in Albarella and Trentacoste's *EthnoZooArchaeology: The Past and Present of Human-Animal Relationships* (2011). The use of ethnographic evidence in conjunction with zooarchaeology is not entirely new, but it is usually considered in brief as part of a larger work or study; this was the first volume to focus on fully integrating the two areas. In doing so, it provided highly interesting insights on aspects of subsistence, while providing alternative interpretation for patterns in the faunal record (e.g. Cerón-Carrasco 2011; Jones 2011). However, the primary focus was still subsistence. While it is true that social and economic conditions influence one another, more work on the social aspect of economic interactions would be of interest, such as Dransart's paper on the social aspects of pastorialism in the Andes (2011). The volume had one paper about dogs specifically, but this examines more about their role in subsistence. However, while it is not the primary focus of the paper, Lupo made interesting notes on the ways humans treat the dogs and how they react and behave otherwise. Bofi and Aka hunters do not regard them as companions, but kept them almost exclusively for the purposes of hunting, and it is not uncommon for them to be beaten or killed once they have ceased to be useful (Lupo 2011: 6-7). Ethnographic perspectives such as these are relevant when considering the ways in which ancient people could perceive dogs and the ways in which the latter could react.

Research on human-animal relationships in zooarchaeology is gathering pace, as shown by Broderick's very recent volume: *People with Animals: Perspectives and Studies in Ethnozooarchaeology* (2016). This considers the ways in which humans and animals depend on one another, and examines a wider variety of relationships. While many of the papers consider subsistence and mobility patterns, the theoretical strides made by Argent's research are excellent; the ways in which animals can consider humans to be part of their own social group and instruct them in practices such as horse riding are explored, and how more senior horses may have had particular status in the Pazyryk community (Argent 2016). However, due to this diversity of topics, specific work on dogs and animals in the ancient world is centred on one paper that examines guardian dogs in the ancient world. From metric, genetic and documentary evidence, Love (2016) suggests that many modern livestock guardian dogs may be descended from types present in the ancient world. The characteristics of these dogs are discussed, but only briefly. The interdisciplinary analysis is excellent, and further research on the ways in which modern humans work with guardian dogs would add flesh to the study.

One drawback to works on ethnography and zooarchaeology is that, other than the aforementioned paper, they tend to focus more on the applications of ethnography to prehistory than the ancient world. There are only a few papers on dogs overall; all in all, some strong methodological foundations have been established, but were applied to temporal and geographical locations far from the classical era. However, this is a general issue with more recent approaches; thus far, they have been largely about prehistory. The need for more integrated work on antiquity, identified by MacKinnon back in 2007, has been recently developed for historical and archaeological work on livestock and dietary habits (Groot 2016; MacKinnon 2018a; 2018b). But even this area needs more work on dogs.

Where this project fits in with this narrative of theoretical and methodological development is to take the most valuable developments of all periods (methodological work, animal pathology, theoretical advances) and pair them with a substantial amount of primary data, and some texts, in order to understand how dogs and humans interacted in Roman Britain. The idea of human-dog relations being a two-way (although not necessarily even) development will be fully explored, and the most recent theoretical ideas from related disciplines will be at the forefront of the interpretation.

2.2. The Present: Current Research in Other Disciplines

2.2.1. Dogs, Animals and Themes in Roman Archaeology

The integration of Roman archaeology, theory and animals began in earnest in the early 1990s, when post-processual approaches were becoming more widely incorporated (Morris 2011: 10). The exploitation of animals in Roman Britain in particular was first considered in relation to how the province was affected by Roman imperialism (Grant 2003; King 1999b). However, there was a large discrepancy between studies of domesticates widely used for food (such as cattle, sheep and pigs) and dogs. The major food domesticates have been widely considered within the context of Roman imperialism and how it affected various settlement types. This has been explored in a number of ways: from comparative analysis of the proportions of different domesticates (King 1999b), to analysis of butchery tools and methods (Maltby 1985a; Seetah 2006), slaughter patterns, body-part counts and even stable isotope analysis of animal provenance (Minniti *et al.* 2014). All of these build a picture of difference in animal husbandry strategies, provisioning of meat and butchery practice between urban, rural and military sites. Additionally, regional and temporal differences within Roman Britain have been explored (Albarella *et al.* 2008).

While this difference has been interpreted differently through the years: from an indicator of how 'Romanised' a settlement is (King 1999a), through to distinct identities of different settlement types (Mattingly 2006: 220-221), the continual engagement between zooarchaeological data and Roman theoretical models is apparent. This is not the case in studies of dogs. While the more recent studies of Roman dogs (Colominas 2016; MacKinnon and Belanger 2006; MacKinnon 2010a) engage with archaeological theory concerning relations with animals and concepts such as agency, they do not connect their work to the wider theme of Roman influence and imperialism. The work that comes closest is Bartosiewicz's study of dogs in the Carpathian Basin in Hungary, where he considers that differences in dog types between two sites may be due to one settlement being Romanised while the other was not (2000: 189). This interpretation, however, is very brief and does not consider more recent theoretical approaches.

Romanisation was originally coined by Haverfield in 1906, but the concept has remained persistent in Roman archaeology until the last 10-15 years. The term was first used to suggest that the Romans brought civilisation to ‘the wild chaos of barbarism’ through cultural assimilation (Haverfield 1912: 12). In more recent years, it has been refined to suggest that people living under Roman imperialism were induced by elites to adopt more ‘Roman’ cultural ideas and practices in a top-down manner (Millett 1990: 212-213). Yet it has been criticised for its simplicity in viewing how native populations would have been affected, and does not consider the differences between social groups or different regions (Hingley 2005; Mattingly 2006). A more recent paradigm that addresses these issues is that of discrepant experience and identity; native populations would not have undergone uniform experiences under Roman rule, and their adoption of new cultural and material practice would have been variable. These questions have been considered in terms of material culture; Mattingly uses material culture to support his ideas of discrepant identity and experience under Roman imperialism in Britain (2011: 218-236). Yet this work may also be beneficial for linking human-dog relationships, and how they changed in the Roman period, to wider thematic issues such as imperialism. Research on Roman dogs has yet to consider their relation to discrepant experience and identity, even though they are an animal that may have physically embodied these experiences of how people related and interacted with them. As discussed previously, several works indicate the likelihood that Roman expansion and trade is linked with the appearance of small dogs in the province in question (Harcourt 1974; Bartosiewicz 2000; Colominas 2016), which is likely the result of imported dogs that were selectively bred for their small size. However, how different groups, settlement types and regions may have interacted with these new varieties of dog has yet to be discussed at length.

Animals and Ritual in Roman Britain

The first considerations of Iron Age and Roman animals beyond an economic approach began with Grant's appraisal of unusual deposits in Danebury (1984). Hill developed these ideas, exploring how animal remains and ritual are linked, arguing that 'Associated Bone Groups' (ABGs) of animal bones may be ritually deposited (1995: 27, 126-127; 1996); several contemporaneous authors also considered ritual deposits on various sites in Britain (e.g. Fulford 2001; Wilson 1992; Woodward and Woodward 2004).

In more recent years, dogs have begun to be examined in greater depth. Works have examined the deposition of animals on Iron Age and Roman sites, and their meaning in human life and ritual; key examples of this include well deposits at Rothwell Haigh (Cool and Richardson 2013), Wattle Syke and Heslington East (Chadwick, Martin and Richardson 2013). These works examine 'special deposits', ABGs and 'structured deposits' in greater detail than previous works; this is particularly relevant as dogs form a significant proportion of these types of deposit. Considerable advances on what may have constituted ritual activity with animals in Iron Age and Roman Britain have also been made. The link between dogs in well deposits and ritual (Hambleton 2006; Roskams *et al.* 2013), between dogs and foundation deposits (Chadwick 2015) and, rarely, dogs in human burials (Booth *et al.* 1996) has been explored.

While these works further the study of animals in Roman archaeology, one oversight is common. They examine the role of animals in ritual and their purposes for deposition, but they still focus on the animal in death, a problem noted elsewhere (Sykes 2014: 12-13). Most authors investigating deposits and their relation to ritual activity do not have the training or analytical skills of a zooarchaeologist and are thus unable to make inferences about important attributes of the animal that would affect its life, such as its size or lesions on the skeleton. The work of Chadwick *et al.* (2013: 176) on Wattle Syke considers this in part: theoretical perspectives are used to consider how animal and human lives were embedded or entangled with one another in agricultural Iron Age and Roman

Britain. However, the links between the theory and the bones themselves are much more tenuous beyond the context of their deposition: key information such as bone gnawing, pathology and even diet would strengthen this link. (Chadwick 2015: 53) has acknowledged the need for more faunal analysis elsewhere, particularly using a biographical approach.

Another method that may strengthen the link between theory and evidence is to compare sites of the same type and/or region with one another. Are the rituals noted on these sites common on other Iron Age and Romano-British sites, or are they unique to a specific type of site, location or a singular site? This would offer further insight. The closest to this is Fulford's review of six large sites in Roman Britain, although the conclusions drawn focus on the prevalence of structured deposition in general rather than specific configurations linked with ritual; from this, he notes no differences in deposition between urban and rural sites (2001: 215-216). Chadwick's review of magic practices in the material record, while focusing more on material culture, begins to categorise recurrent structured deposits (e.g. dogs buried under doorways), but using a small number of case studies (2015); further work with more faunal data would be particularly illuminating. A significantly larger dataset has been used in Morris' volume on ABGs in Southeast England and Yorkshire, which allows for more nuanced analysis of ABG trends by specific animal and site type. However, the research does not focus specifically on ritual practices (2011).

There are also significant issues in older works with assuming that any unusual or articulated deposit represents some form of ritual. Papers examining these types of deposit, as discussed, also tend to focus on a single site or small number of case studies, making comment on wider inferences or trends very difficult. In order to further understand the context of these types of deposit, it is also important to consider their prevalence, particularly compared to deposits which do not fit the bill. This has, however, been identified as needing more research by other authors (Cool and Richardson 2013:

24-25). This is a particularly important question when considering the changing trends in interpretation: before the rise in interest in ritual deposits, they were more frequently assumed to be practical deposits (Morris 2010a: 20). Some progress has been made in the term 'structured deposits', which refers to deposition that is seen to be intentional or 'the result of a careful selection of items'. These have been identified by Cool and Richardson using the criteria of deposition that is out of the ordinary, such as repeated deposits of items that are unusual for the time period and/or material that is unusual for the area (2013: 19). More dedicated work on this is needed, especially as there are so many dog ABGs in this period; what factors make a dog deposition usual or unusual?

Herein lies another issue with work on ritual: there is frequently still a dichotomy between ritual and practical (Morris 2010b: 266); deposition is often assumed to be wholly one or the other. In the case of ritual depositions of animals, the animal is often assumed to have been slaughtered specifically for deposition. This may well be the case, but unless specific evidence for slaughter shortly before deposition exists, it is also possible that the ritual and practical intersect: the animal may have died and been incorporated within ritual practice. Puppies are common topics in this dichotomy: either they were culled (Maltby 1993: 72-73) or sacrificed (Woodward and Woodward 2004: 77). Why not both? Excess puppies may have been sacrificed on occasion. However, this must not be taken to mean that all depositions were an equal balance of ritual and practical. Some may have been much more heavily skewed towards one or the other. This project will incorporate the most current work on ritual and its critiques when considering human-dog relationships. Each ABG examined has a story behind its deposition, which may be ritual and/or practical in basis; this story may reveal, in conjunction with a detailed faunal examination, something of the way humans interacted with it.

2.2.2. Canines in Ancient History

Dogs are also considered independently of wider themes in ancient history. While the major sources on dogs in the Roman world have been identified, for instance Columella's

De Re Rustica and Pliny the Elder's *Naturalis Historia*, the wider implications in terms of human-animal relationships have not been discussed in depth. There are two major issues with the study of dogs in ancient history that hinder more comprehensive discussion. The first is their limited scope: although there are close to 200 records of dogs in the Loeb Classical Library, usually only the best-known of these sources are used and discussed (cf. Kitchell 2004; Phillips 2001). While these sources are valuable, avoiding a broader, more systematic analysis of the sources prevents a more comprehensive discussion of human-animal relationships. For instance, many works make brief references to day-to-day practice, such as tethering dogs outside buildings. There are also references to systematic violence by Romans against dogs in conquered cities, but these have not been discussed outside of a single work on violence in Late Antiquity (Long 2006: 228).

The other drawback, partly due to the first issue, is that dogs are not extensively considered in terms of their relationships with humans and influence in Roman society. Few works within the past 50 years have extensively discussed ancient animals in the first place, and most discuss them in terms of their functions or a brief acknowledgement of their connection with the supernatural. Even a recent work, *Animals in the Ancient World*, considers animals more in the form of a descriptive bestiary than a thematic work. While the attention paid to more obscure animals in the ancient world is commendable, the drawback is that the section on dogs is, by necessity, limited. The human-dog relationship in the Roman world is discussed, but in a fairly basic manner, using the most widely cited sources (Kitchell 2004: 53).

This lack of attention is apparent in other works. Phillips largely discusses types of ancient dogs along with their care and husbandry. Attitudes are only discussed in a short section at the end of the chapter. Although some excellent points are raised, such as the Romans' ambivalence towards dogs (Phillips 2001: 101), this is a topic in serious need of further discussion. The thematic volume *A Cultural History of Animals in Antiquity* suffers from the same lack of specifity (Kalof 2011); there is little coverage of Roman animals, let alone dogs. Even the papers that offer more extensive coverage of the Roman world offer little specific discussion on dogs, even where the theme is relevant, such as hunting (Hughes 2011). Toynbee's volume on animals in Roman life and art is more specific to Roman animals, and uses a good range of both textual and artistic sources. However, it does not extensively discuss these sources beyond basic interpretation of the roles of dogs (1973). It would be interesting to consider the attitudes Roman had towards dogs in more detail.

More thoughtful coverage of human-animal relationships is apparent in Newmeyer's *Animals in Greek and Roman Thought* (2011). The book considers a wide variety of themes that affected human-animal relations, such as perspectives on animals as moral beings, and refers to less commonly-cited sources. However, the book is intended to be a sourcebook, not a comprehensive analysis of the subject. In a similar vein, MacKinnon's chapter on pets considers the boundary between pet and working animal in the Roman world, but as a general chapter on animals, offers only a brief analysis of dogs (2014). Ultimately, there is still a need for research that places human-animal relationships at the forefront of research, rather than a brief discussion using the most commonly-cited sources; as the animal with the closest and most intimate relationships with humans, there is a need to consider dogs in particular.

2.2.3. Insights from Human-Animal Studies and Anthropology

Within the humanities, human-animal studies surged in popularity during the 1990s following an 'animal turn' that argued that the focus on only human development of society and culture ignored or downplayed vital animal contributions; this is otherwise known as anthropocentrism (Fudge 2002: 3-4, 15). While studies focusing more on animals existed before this period (e.g. Ritvo 1984; Yi-Fu Tuan 1984), they were much smaller in number and existed largely within anthropology; key theoretical volumes such as *In the Company of Animals* and *What is an Animal?* date to this decade (Ingold 1994; Serpell 1996). The area has much to offer the study of humans and animals in the past. It encourages the adoption of a less anthropocentric mindset, and to consider animals not only as a reflection of humanity; human-animal relationships are, after all, two-way, and animals make their own contribution to this relationship. Several relevant themes on humans and animals run through the literature, to be discussed in turn.

Categorising Animals

Before considering the major literature on human-animal interactions, the ways in which we initially categorise animals are one relevant theme in human-animal studies. Many early works offer simplified categories, or even speculation on the way humans perceive all animals; for instance, pet animals and animals consumed are offered as categories, but there was little consideration of nuance within these categories (Serpell 1996). Yet the way humans perceive animals may be highly complex and variable; not only do we have large meta-categories of animal, such as pets and meat animals, but they may be affected by characteristics of a species, social group and physical environment. For instance, many owners will relate to a pet hamster differently to a dog, in part due to their different characteristics; hamsters have considerably shorter lives than dogs, and much less social intelligence as solitary rather than highly sociable animals. This is key when considering a singular animal in the Roman world, within a singular province. While Roman philosophers consider animals as a whole, this may not be reflective of the way a singular species is treated by comparison. While these sources are valuable and can give vital clues on the overall way animals are considered, a much more nuanced approach needs to be taken to understand how Roman Britons understood dogs, not animals in general.

However, other work challenges dichotomies: one being that animals can only be beings that are seen as individuals or objects of economic value only. Fudge's work examining animals in wills and inventories in Early Modern England argues this is a mistake and that animals can be both; the example of a heifer bequeathed in a will (Fudge 2013a: 194-195). While this does not automatically mean the same happened in other historical periods, such as the ancient world, it is valuable for considering that it is a possibility. It is also worth considering that the relative values of each may be affected by context; that in some contexts animals may be seen more as individuals, and in others more as a group. It may also vary according to the animal in question.

The two fields also provide food for thought on human-animal relationships. A key aspect of this is to suggest humans are not the centre of all relationships, but simply a part; 'by refusing humanism, we place ourselves next to the animals, rather than users of the animals' (Fudge 2002: 15). While there are cognitive capabilities and subsequent cultural and technological achievements that are unique to humans, 'decentering' the human allows for a better understanding of the contributions animals make to the environments in which we live. This is helpful not only for companion species, but commensal ones that live alongside humans (cf. O'Connor 2013).

Some claims, however, require further scrutiny. Commonplace is the assumption that human-animal relationships are inherently contradictory; that human care for a pet is entirely contradictory to indifference of the conditions in which farm animals are kept and slaughtered (Arluke and Sanders 1996: 5). As humans are apt to care more for other humans that are closer to them, which may include physical proximity, emotional closeness and/or shared values and identity, this is not a particularly contradictory tendency. While commitment to welfare for all animals is a laudable aim, and well worth pursuing, this does not necessarily make a common tendency to care more about animals that have some degree of physical, emotional or even cultural proximity a contradictory one. The issue with this argument, in terms of this work, is that it can carry over to assumptions about human attitudes in the past: that they were inherently contradictory.

More recent work in human-animal studies has made impressive strides towards challenging common assumptions that simplify human-animal relationships, when they are frequently more complex. One of these is the issue of human-animal equality alongside ethical obligations. Often there is the idea that humans use inequality between themselves and animals as justification for poor treatment. While this can and does happen, it is not then a given that this inequality always leads to poor treatment. Patton considers, instead, that societies may be hierarchical and have 'ethical relations and obligations' with those lower in the hierarchy (2003: 85).

A particular area of interest is the relationship humans and animals have when the latter are kept as pets. Fudge's volume on pets is perhaps the most comprehensive analysis of the ways in which humans and pets interact, and brings up a number of key points: that pets have both real and imagined functions, that they can challenge artificial boundaries between the home and the outside world by living with humans, and that pets have their own form of language. When thinking about pets, an excellent point is raised that some degree of mutual comprehension is possible between human and animal; although neither will fully be able to understand the other, by each side learning something about the other's 'language', they may engage in dialogue with each other (2008: 14, 19, 64-65). These provide valuable ideas for looking at humans and dogs in a Roman province; while it is important to be wary of making the assumption that dogs were kept as pets in the exact same way as the last 100 or so years, the nature of such a relationship may have some echoes or origins with ancient interactions with dogs.

Other authors, however, assume the pet (and indeed, all animals) are the products of human dominance, albeit dominance with a friendly face (Yi-Fu Tuan, 1984). Yet these assumptions lack more nuanced discussion on actual experiences with animals beyond perhaps a brief mention of an ethnographic case study or two. A few studies engage with direct experiences (Derrida 2002; Smith 2003), the most relevant being Haraway's *The Companion Species Manifesto* (2003). This examines human-dog relationships from a post-humanist perspective, but incorporates the ideas of trainers who work with dogs. It reflects on the ways in which humans and dogs work with each other in certain tasks, and the levels of trust and co-operation necessary. Although domination is also an aspect of relationships to consider, Haraway proposes other interactions that occur between humans and dogs; interactions that may also have occurred in Iron Age and Roman

Britain. She also notes that while it is true that dogs living with humans will always be changed by the experience, without considering further, this could be interpreted as simple dominance. Yet the human will be changed by the dog too (2003: 62-63). New types of dog in Britain may have changed human behaviours towards dogs, thus signifying a more complex relationship than simple dominance.

Engagement with the Past

An overarching theme in anthropology, in particular, is the way in which hunter-gatherers perceived and interacted with animals. Considering these perspectives is important, as societies with domesticated animals may be offered as a contrast to hunter-gatherer lifeways; this may be both beneficial and a hindrance to studying animals in the Roman world. For instance, Ingold proposes that animals were domesticated through a cognitive shift in the way they were perceived. Hunter-gatherers initially trusted that sufficient resources for subsistence would be present in their environment, and as part of this that animals would give themselves up to the hunter once the correct rituals were observed. On the other hand, pastoral societies did not have this trust, and domesticated animals in order to exert direct control (Ingold 1994: 14-16). While this prompts consideration of the ways in which human-animal relationships can manifest and change, there are some serious flaws regarding the proposal. Hunters had little familiarity with individual animals, unlike pastoral societies that were in continual contact with the beasts they kept, thus allowing for more personal human-animal relationships to develop (Armstrong Oma 2010: 177-178). Additionally, this makes a generalisation that all societies, post-Neolithic, exerted similar levels of control over their animals; some pastoral groups exert loose control over animals in many regards and trust that they will participate in the relationship, such as returning to their homes after grazing (Fudge 2013a: 193). What is more likely is that these two concepts are present on a continuum and may, in fact, be able to coexist with one another. Additionally, this concerns only animals domesticated for food. Dogs provide services if they are owned, and while coercion is one such way of obtaining some services, trust and mutual co-operation are necessary for others.

Another major drawback to anthropology and human-animal studies is that they largely focus on human-animal relations in the present, or comparatively recent history. They usually focus on understanding the past beyond the last 200 years (e.g. Isenberg 2002; Mangum 2002; Ritvo 1997; 2010) and sometimes consider the later medieval period (Fudge 2013a; 2013b), but have not considered periods beyond this, and no study yet exists by an author with a particular interest in the ancient world. Only one broader work on the ancient world exists within the field, but it examines the entirety of antiquity, from Mesopotamia to Rome, and its relationship with cattle (Schwabe 1994). The most prolific civilisations of the Mediterranean and Near East varied enormously from one another in many regards, and the Roman world specifically is under-studied. Scholarship that focuses on smaller time periods and geographical locations is needed in order to understand more the relationship between cultural context and human-animal relationships.

The present is sometimes compared with the past in studies, but claims of what relationships between humans and animals were like in the past need to be taken cautiously without further study; it is dangerous to automatically assume they were very different to the present. This also precludes the possibility of change in the distant past. Human relationship with a given animal may transition from one very different to the present to one less so, or vice versa. As this is a key question I ask of the Iron-Age Roman transition in regards to dogs, it is crucial to be cautious. In a couple of instances, the argument veers dangerously towards 'just-so' stories about the past, without the use of enough evidence. One example of insufficient engagement with the ancient world is apparent in Serpell's (1996) misuse of a Plutarch quote:

‘Caesar once, seeing some wealthy strangers at Rome, carrying up and down with them in their arms and bosoms young puppy dogs and monkeys, embracing and making much of them, had occasion not unnaturally to ask whether the women in their country were not used to bear children; by that prince-like reprimand gravely reflecting upon persons who spend and lavish upon brute beasts that affection and kindness which nature has implanted in us to be bestowed on those of our own kind.' (Originally from Plut. *Vit. Per.* 1)

Serpell interprets this as hatred of pet-keeping (1996: 24). Yet this demonstrates a lack of knowledge or analysis of the context of the quote. It is a rhetorical opening to the Life of Pericles, which concerns Pericles as a statesman and his taking Athens into The Peloponnesian war against Sparta, leading to huge amounts of suffering for the Athenians. Plutarch is actually emphasising more the lack of affection for other humans that was evident in that time. There are also assumptions, in part from this quote, that only the elite kept pets (1996: 46). This raises two problems: lack of evidence is not evidence of absence, and that pet-keeping can actually overlap and coexist with functional roles (Haraway 2003: 38).

This issue of generalising the past has, however, been addressed more recently in Fudge's examination of human-animal relationships in Early Modern England. While a strong current of humanist thought, one that considered humans to be exclusively rational beings, was present in the philosophy of the time, this does not reflect the attitudes of many in everyday life. Fudge notes a tendency in many post-humanist works on humans and animals to take this literature at face value and conflate the history of philosophy with the history of human-animal relationships (2013a: 183). This is important to consider when examining Roman literature.

In very recent years, archaeologists are beginning to take an interest in human-animal studies. Argent's work on Bronze Age horses incorporates key concepts in order to analyse a Pazryzk horse sacrifice. The contributions horses made to Pazryzk society are considered in light of their similarities with humans rather than differences; namely, that horses live in social groups that are led by older animals, much like humans. This similarity means that older domesticated horses may guide inexperienced humans when riding as part of the same social group; Argent speculates that this characteristic may have given older horses special status as 'elders'. Two of the horses that were sacrificed wore special helmets that marked them from the others, and it is possible that this was linked with age (Argent 2016: 25). Ultimately, more work of this calibre needs to be undertaken, so that the new perspectives human-animal studies offer can be explored while incorporating specialist spatiotemporal knowledge.

Works on humans and animals provide some very valuable inspiration for studying animals in antiquity, and flag some key concepts for the interpretation of human-dog relationships in this thesis. However, some arguments may (inadvertently) impose generalisations on the past; distinguishing the two is very important. Ultimately, human-dog relationships need to be treated as highly complex and not automatically contradictory, tainted by domestication or human dominance; animal contributions, overall cultural perceptions of dogs and the day-to-day mutual interactions are all constituents of this relationship.

2.3. Advancing Dog Research and Interdisciplinary Approaches

While studying the physical remains of dogs is mostly the remit of zooarchaeology, the wider themes of animal movements and human-animal relationships span across multiple disciplines. All have gaps in their study of animals, particularly dogs, that would benefit from an interdisciplinary perspective. However, critical evaluation of previous research provides the theoretical framework for this project.

2.3.1. Main Theoretical Influences

The theoretical basis of this project is influenced by several paradigms and disciplines, but is most heavily based on a new direction within zooarchaeology: social zooarchaeology. A cornerstone of this direction is, as previously discussed, considering the animal in life as well as death. It is easier to determine what happened to a dead animal in terms of burial context and/or butchery, and what its significance was in this regard. Yet even post-processual archaeology has continued this emphasis on the dead animal; work on the ritual aspects of animals has focused on their manner of death (i.e. a sacrifice). However, animals have played significant roles in rituals when alive (Sykes 2014: 114-115). Therefore, this project will consider the relationships humans and dogs had in life as well as death.

Another key concept drawn from social zooarchaeological works is that of a multidisciplinary approach to the project. It has been acknowledged that zooarchaeology alone is limited in the inferences it can make about the past (Sykes 2014: 6), and as social relations are more difficult to elucidate than economic or subsistence activity, incorporating other disciplines can allow for a richer interpretation and conclusions. The other key discipline incorporated, albeit in a secondary capacity, is ancient history; this is because the evidence is abundant and particularly valuable in understanding attitudes towards dogs. When interpreted together with the faunal evidence, they will ideally complement one another and provide a better overall picture of human-dog relations, through time and space, than only one form of evidence.

One other theme within social zooarchaeology is the mutual influence humans and animals had on one another. Often, relationships between past humans and animals are perceived to be unidirectional, with the animal as a passive participant. With archaeology conceding that inanimate objects have agency: the ability to independently influence humans, and acknowledging how humans and material culture are intertwined (Hodder 2010), the application of this concept to animals is emerging (Argent 2013; Armstrong Oma 2010) but still fairly new (cf. Johannsen 2012). What animal agency specifically entails has not yet been outlined in detail in works on social zooarchaeology, but other works outside of archaeology may be used to consider this more carefully.

Considering the specific ways in which animals, especially dogs, can act as agents is particularly crucial to this study. It is vital not to discount the actions dogs take and how they influence humans and human societies. It is clear from classical texts in the Roman world that the ways in which dogs behaved, and the traits the Romans attributed to them, had a key influence on Roman culture and society. Writers admired dogs for their bravery (ps-Oppian *Cyn*. 1.412-22), loyalty and fidelity (Phaedrus. 1.23) while expressing revulsion at their rapaciousness and greed (Plut. *Mor. Quaest. Rom*. 111). These traits could be upheld as something to admire or emulate, or used to compare people unfavourably (Plaut. *Curc.* 110.). There is also the issue that in some contexts a dog's agency could be constrained. Within the Roman world dogs were fully domesticated even if some animals lived as strays, could be bought and sold and selectively bred to produce desirable traits. Humans held great amounts of power over the life of a dog and were quite capable of constraining their agency; as the works of Varro show, male dogs could be castrated (*Rust*. 9.15). As part of the key research aims, one aim will be to understand their subsequent influence over humans.

Textual evidence, while biased in favour of the elite and their favoured topics for discussion, can offer valuable evidence of human attitudes towards animals and their emotional and/or cultural components (such as attachment or contempt). Discussion of animals in classical texts includes debates such as the capacity of animals to act morally which may have affected the ways in which humans interacted with dogs or reacted to certain aspects of their behaviour. For instance, Democritus maintained that animals were capable of choosing moral and immoral actions, and that consequently it was just to slay animals that had acted wrongly, while Cicero regarded animals as incapable of reason or justice and on this basis existed for human use (Cic. *Fin*. 3.67; *Nat. D*. 2.154-159; *Off*. 1.50; Newmeyer 2011: 75-76, 84). While applying this wholesale to Roman Britain would be a stretch, it is valuable context when considering non-accidental injuries in dogs from the Late Iron Age to the Roman period. If Roman occupation was correlated with an increase in abuse, could these attitudes be a factor? Textual evidence may also indicate practice as regards dogs that are currently archaeologically impossible to detect. One example is the deliberate selection of dog coat colour in relation to their role, as noted by Columella (*Rust*. 7.3).

When engaging with the classical sources, caution will be made with applying the more generalised statements to dogs specifically. This is in response to some of the generalisations in literature about how humans perceive and interact with all animals. Returning to the Cicero quote, we can question it: did he see all animals that way? Are dogs, arguably much closer to humans in proximity and social functioning, any different? Understanding the context of the text, and of the author themselves, is very important - hence why commentaries will be used wherever possible.

Human-animal studies and anthropology also have an important influence in the theoretical basis of this thesis; the earlier review of the literature flags several key points and responses that form part of this basis. The most fundamental point is 'decentering' the human and acknowledging the importance of animals alongside people studied in the past. While recent social approaches to zooarchaeology have covered this issue, albeit in a slightly different way, engaging with the literature directly forms this argument lends support to its importance. Expanding on this, perspectives such as Haraway (2003; 2008) will be used to consider not only the ways in dogs contribute to the relationship, but also how they can change human attitudes and behaviours.

One dichotomy of human-animal relationships which needs a different view is that animals are either important as individuals or as economic components, when in fact they may be both. The importance of each may vary from animal to animal or even change throughout its life; therefore, when examining dog ABGs, both dimensions will be explored. Another is that power imbalances are incompatible with ethical relations towards the party seen as lower in the hierarchy; it is otherwise possible to assume that dogs will automatically be treated poorly, and to judge pathology to be the product of abuse based on this belief (rather than using criteria such as Binois. *et al.* 2013). In similar vein, the animal needs to be considered as a multifaceted being; one with both real and imagined functions in society (Fudge 2002: 14).

In 2.2.2., I questioned the literature that argues for wholescale human dominance of animals, in part using other perspectives within the same broad field. Although the dominance of nature is an important aspect of Roman elite ideology, expressed through hunting and spectacles (Hughes 2011; Shelton 2011), it is unlikely that this attitude was consistently applied across all animals by all groups of people (Saelid 2006: 12-14). Given that Britannia was also a distant province where many pre-Roman cultural practices persisted (Mattingly 2006: 457, 472-478), this possibility is even less likely. Indeed, imperial dominance of the landscape is less apparent in Wiltshire than Montagne Sainte-Victoire in France (Roberts 2014). Thus, the possibility of dominance being part of the relationship between humans and dogs in Roman Britain will be considered; it will not, however, be taken as given and will be considered alongside other elements of the relationship that may even subvert it, such as trust and mutual understanding. In a similar vein, the common claim that attitudes towards animals in the past were inherently anthropocentric will be questioned throughout the project. It is of course possible that the Romans and/or Britons in the Iron Age and Roman periods had highly anthropocentric attitudes, but this cannot be taken as given.

How dogs affected human identity in Roman Britain may be, once other aspects of the social relationship are explored, investigated using the idea of discrepant identity: that responses to Roman imperialism would have varied according to social group, and that each would have discrepant experiences within it (Mattingly 2006: 17-18). While the concept has usually been applied to other archaeological evidence, such as material culture and architecture, it may be used to look at how animals reflected change (or lack thereof) in dietary or cultural norms amongst different social groups (Mattingly 2006:

474-476; Taylor 2013: 182-184). Dogs in particular may reflect change in social relationships between humans and animals. First of all, human attitudes towards dogs, particularly in regards new types and their physical welfare, can reflect the social groups to which they belong, and aspects of their own identity.

2.3.2. A Combined Approach

After discussing the key theoretical concepts that emerged from the reviews in 2.1. and 2.2., I have been able to develop an approach for the project. Three main components govern the data to be collected, the methods for analysing it and the conclusions I will attempt to draw:

1) An interdisciplinary and multiscalar strategy: as faunal data can give richer insights when used with other forms of evidence, using select texts and commentaries may enhance the bone data, and give additional context in relation to the Continent.

2) Understanding human-dog relationships: they are complex, multifaceted and two-way arrangements. While human dominance is often a part of them, it is not the sole, and often not even the main, component.

3) A biographical approach: dogs exist as populations, and may be studied in that way. But investigating dogs as biographies wherever possible is important, and can show how individual animals lived and interacted with humans. Concurrent to this, understanding the life of a dog, not just its death, is an essential component.

2.3.3. Continuing the Story

From reviewing the past century of zooarchaeological research on dogs, particularly dogs in antiquity, there are still gaps that need to be filled. How the morphology of dogs changed in response to Roman trade and conquest is evident; how attitudes towards dogs were affected, and how this varied between different groups, has not been studied nearly as thoroughly. Generally, zooarchaeological studies have conducted only small-scale research on individual dogs aside from morphology, despite the need for such research. Most studies of pathology focus on 'interesting specimens' and most studies of dogs as individuals use very small datasets. Within a discipline that is taking more interest in how animals interacted with humans during life, beyond purely dietary or economic considerations, my own contribution is designed to continue and develop the narrative.

More broadly, the project will contribute to wider Roman archaeology and history by bridging the gap between these areas and the study of animals. The study will also make contributions to scholarship in other disciplines. As discussed, study of the more distant past in human-animal studies is lacking. This gap will be addressed, through the use of dogs as a case study, and demonstrate a framework for an approach to antiquity; one that places the dog itself much more firmly within scholarship while avoiding generalisations about human-animal relationships, and using significant amounts of archaeological and textual evidence. Establishing what evidence will be collected, and how, is the next task.

Chapter 3: Materials and Methods

This chapter outlines the materials and methods used in this project. In all, this section is designed to link up the specific methods and materials to the aims and research questions, and provide a technical resource to refer back to in subsequent chapters. It is also partially designed to outline the prerequisites for aim A5, the development of an animal biography. I will also discuss the process of selecting suitable data to record for a biography, and why particular methods were chosen over others.

3.1. Materials

To explore the themes outlined in 1.2, I will use a wide variety of materials. This includes individual dog skeletons and published zooarchaeological data about dog presence on sites across England. Combined, this provides a robust corpus of data to explore how human-dog relations changed through both time and space at different scales. The former will be used to explore dog health and welfare. Classical texts will be particularly useful for placing the bone data within the context of the wider Roman Empire, Romano-British identity and offer insights into aspects of human-dog relations.

Faunal Remains in Britain: Considering Excavation Practices

While examining sites from across Britain, it is vital that the ways in which these sites have been excavated is considered. Excavation practice may affect the collection of faunal remains in several ways: the overall importance placed on faunal remains, the types of faunal remains found, the representativeness of faunal samples, the types of contexts investigated (thus biasing the recovery of faunal remains from other contexts) and the recovery of associated groups. ABGs in particular are less prevalent in certain sites and regions (Appendix E); prematurely ascribing these to a lower prevalence of ABG deposition or keeping of dogs would be a serious error. We must consider the background of late prehistoric and Romano-British excavation in Britain first.

In Britain, excavation practice has tended to vary according to the type of site excavated, and this variation has its origins in the antiquarian tradition of the early 20th century. Military sites and villas would be excavated largely for their structural remains, in the most prestigious locations that were less likely to yield animal bones. Another trend in many of these reports is to focus largely on the material culture (see below); extensive analysis of pottery and other items such as metalwork and glasswork are frequently undertaken, in far more detail than other types of site. This is, in part, understandable; they provide an opportunity to examine dense assemblages of imported and/or 'high-status' goods. But the environmental and faunal analysis are rarely of the same calibre.

In recent years, more nuanced approaches to excavation have been taken. However, this is far from universal. Many reports of military sites from 1980 onwards still exclude animal remains and focus on structural and material culture e.g. Haltonchesters (Dore and Gillam 2010) and South Shields (Bidwell and Speak 1994; Miket 1983). It is unknown if this is due to excavation practice, taphonomy or selective bias in the production of the report. The bias towards structural and material evidence is less prominent than work produced earlier in the century, as many of these more recent publications have undertaken some environmental analysis of plant and even molluscan remains but show no faunal report. This suggests that poor preservation of bone may potentially be a factor. There may be also a regional element to the lack of military sites. Many military sites are in more marginal areas of the province, such as much of the north; these are areas where less excavation work has been undertaken in general (see Fig. 3.1).

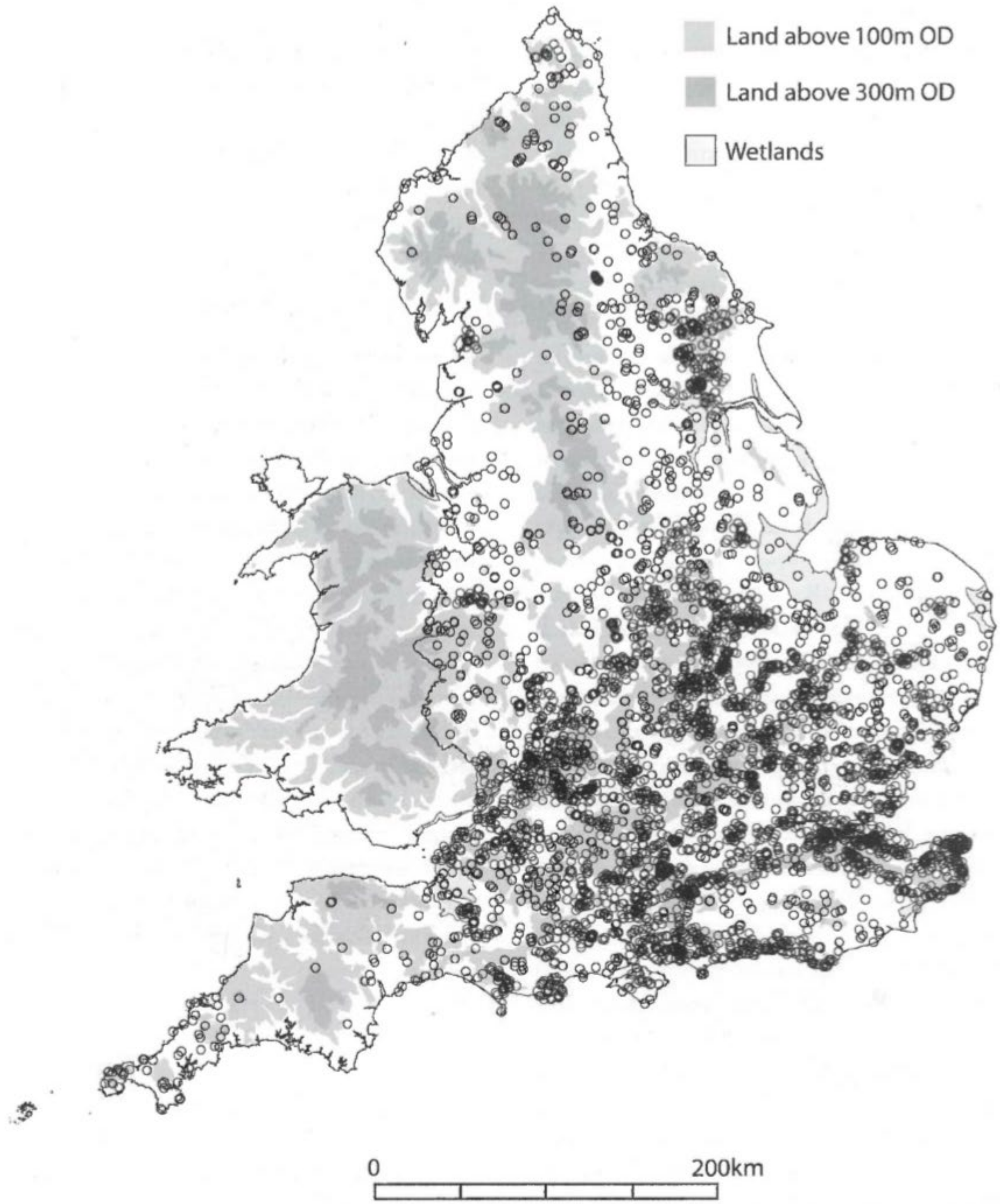

Fig. 3.1. Map of excavated Romano-British sites (Taylor, 2007: 17).

3.1.1. Primary Data

Dog remains are the most common animal on Iron Age and Roman sites in Britain after the 'Big Four' group of cattle, sheep, pigs and horses (Appendix E). They are the animal most likely to be found as partial or complete skeletons, making them a very valuable resource for archaeologists. However, dogs are rarely recorded systematically in reports, and analysts focus on features of interest, or have too little room in the report for a full analysis. As no standardised system is commonly used, I will obtain and record primary dog material using a purpose-built system.

The unit for selecting dogs will be the Associated Bone Group, or ABG. A term originally coined by Hill (1995: 27), it offers a more precise definition of what exactly the material is, over the more vague terms of 'skeleton' and 'partial skeleton'. Dogs become skeletons when all the soft tissue decomposes, but these skeletons are almost always affected by taphonomic processes before and after burial. This will lead to a varying level of bone loss and degradation. When the skeleton is finally excavated, it is then an ABG.

An ABG is one of the following:

1) Bones in articulation.
2) Bones that are deposited in articulation, but become disarticulated through taphonomic processes and can be shown to be from a single animal.
3) Bones deposited disarticulated, but in association with one another and from a single animal.
(Morris 2011: 12-13)

There is an extra condition to be counted as an ABG in this dataset: there must be bones from more than one body part. This is because the study aims to look for dogs that were buried whole, and individual bones or body parts may have been removed from the rest of the skeleton before burial. While depositions of heads and haunches are well worth studying, my work aims to create full biographies, and therefore needs dogs that were initially deposited whole.

Suitable specimens were found from a general survey of sites across England. The vast majority of ABGs are located in a small region of England, across the counties of Dorset and Hampshire (Appendix E), so this was selected as the area of focus; other regions of England only have small numbers of dog ABGs. However, several ABGs from other regions were included in the final dataset. The University of Nottingham's Bone Lab had ABGs in storage from Roman Baldock, Caistor and Fishbourne, and these were loaned to Leicester. Several of these ABGs had previously been analysed for carbon and nitrogen stable isotope values, of which the raw values are recorded in Appendix E.

The total number of ABGs I will record is 85. While the sites they come from contained more dog ABGs (as stated in their site reports; see Table 3.1), many of these were unsuitable for recording. Some ABGs were found in large mixed bags where individuals could not be differentiated from each other. Owslebury and Greyhound Yard had particularly high numbers of mixed deposits, accounting for a high number of the dog ABGs on these sites.

Other ABGs comprised only a single bone, according to the report, and were unlikely to be deposited whole. A substantial number of ABGs were noted in the site report, but were missing from the archive collections. The latter two issues were particularly acute for Oakridge Well. Of the 231 ABGs noted in the summary report, less than 20 were noted and described by context and of these, only four could be found in the archives. However, all sites had some single-bone and missing ABGs.

Site Name	Region	Dog NISP	Total Dog ABGs	ABGs Recorded	Report
Iron Age					
Danebury	South	5503	U	10	Grant 1984; Grant and Serjeantson 1991
Balksbury Camp	South	745	29	6	Wainwright and Davies 1995
Suddern Farm	South	710	11	3	Hamilton 2000a
Houghton Down	South	722	7	2	Hamilton 2000c
Nettlebank Copse	South	503	9	2	Hamilton 2000b
Little Somborne	South	120	2	1	Neal 1980
Owslebury	South	158	4	1	Maltby 1987b
Roman					
Owslebury	South	4936	95	21	Maltby 1987b
Greyhound Yard	South	4572	94	21	Maltby 1990
Oakridge Well	South	4398	231	4	Maltby 1993
Fishbourne	South	106	Min. 1	1	Manley and Rudkin 2005
Baldock	East	U	17	11	Chaplin and McCormick nd.
Caistor	East	U	2	2	Bowden in press
Unknown					
Owslebury	South	U	Min. 2	2	Maltby 1987b
Total		22473	502	**85**	

Table 3.1. Outline of sites from which dog ABGs were recorded.

The Sites in Detail

Baldock

Excavated from 1968 – 72 by I.M. Stead for the Inspectorate of Ancient Monuments, Baldock was a small township located in present-day Hertfordshire. The settlement had urban features, but did not have any known administrative function, and was not close to a major road. It was settled from the 1st century BC through to the end of Roman occupation (Stead and Rigby 1986: 7-8, 29, 84).

The site was rich in faunal remains. Although the exact NISP is not available, at least 1282 animals were represented, of which 38 were dog. A very high number of canine ABGs were recorded, ranging in deposition from the mid-1st to late 3rd centuries AD (Chaplin and McCormick nd.).

Fisbourne Roman Palace

Although occupied during the Late Iron Age, the main palace itself was constructed in AD 75 as a private residence for the client king Tiberius Claudius Togidubnus (Manley *et al.* 2005: 91-92; Sussex Archaeological Society 2019). A high number of animal bones were found from the Roman contexts, 19087 in total, and has been studied extensively in terms of rare animals not usually found on other Romano-British sites (Sykes *et al.* 2006). Within this assemblage, 106 dog fragments and 1 ABG were found.

Caistor Roman Town

Excavation is ongoing at Caistor, which begun survey work in 2005 and major excavations in 2012. The town was far larger than Baldock, as the *civitas capital* of the Iceni tribe. Established in the late 1st century AD likely on the site of a major Iceni settlement, it was known as Venta Icenorum and located 5 miles south of present-day Norwich (Bowden 2012: 30-33). The faunal remains have yet to be finalised, but a substantial number of dog bones have been found thus far. Among this are two ABGs (Bowden in press). Bones were hand collected and/or sieved.

Owslebury

Of the sites occupied during the Roman period, Owslebury has the most extensive evidence of pre-Roman settlement. Evidence of Neolithic, Bronze Age and Early Iron Age occupation were present, but the main pre-Roman settlement was a banjo enclosure from the 1st century BC. In the Roman period, the site was a farming settlement close to a Roman road leading to Winchester (Collis 1968).

Excavation was undertaken between 1961 and 1972, mainly by John Collis (2011). The animal bone assemblage, dating to the 1968-72 excavations, is one of the largest ever recovered. All hand-collected, 110 000 bones were recorded by Maltby (1987b). Most of the assemblage dates to the Roman period, but 1161 dog bones date to the Late Iron Age.

Greyhound Yard

Greyhound Yard is the only southern Roman site outside of Hampshire, instead falling within the boundaries of modern-day Dorset. The excavations form part of the large Roman town of Dorchester, or Durnovaria, created from a Conquest-era military settlement around c. AD 65 (Woodard *et al.* 1993). One of the largest Romano-British settlements after Owslebury, over 41 000 bones were recovered (Maltby 1990). Most of the assemblage was obtained from the excavations in Greyhound Yard car park in 1984 (Woodward *et al.* 1985), supplemented by some earlier material from the adjacent Old Methodist Chapel (Woodward 1983).

Oakridge Well

Located north of Basingstoke, Hampshire, Oakridge II was excavated in 1965-66. While Oakridge consists of a large settlement complex, the bulk of the faunal material was found in a huge well extending to 87 feet in depth. This material consists of depositions ranging from the Early to the end of the Roman period. Many dog bones were found, and a huge number of ABGs were recovered. Most of these, however, were either mixed deposits that could not be separated, in particular large numbers of puppy deposits (Maltby 1993: 47-48, 59).

Danebury

One of the largest hillforts ever found, Danebury contains a staggering assemblage of nearly 600000 bones in total. Two main rounds of excavation were undertaken, both by Cunliffe: the first in 1969-1978 and the second in 1979-1988 (1984; Cunliffe and Poole 1991). Occupied for a lengthy period, mainly from the 6th of 7th century BC to the 1st century AD, only minor activity took place after the Conquest (Danebury Trust 2003). A large number of ABGs, both dog and other animals, were found, and the assemblage was one of the first to investigate why animal remains were placed into unusual contexts and/or buried whole (Grant 1984).

Balksbury Camp

One of the largest Iron Age settlements in Hampshire after Danebury, Balksbury Camp was an enclosed settlement near Andover. Two excavations were carried out in total, in 1973 and 1981. The enclosure was first built in the Late Bronze Age, and the main period of occupation ran throughout the Early Iron Age. Occupation continued through the Middle and Late Iron Age in a smaller section of the enclosure; however, the main assemblage dates to this phase. Despite occupation continuing through the Roman period, no animal remains were found. An unusually large number of ABGs, both dog and other animals, were found from the first excavation, from which the dog ABGs in this sample were drawn (Maltby 1985b; Maltby 1987b; Wainwright and Davies 1995).

Little Somborne

The site of Little Somborne, Hampshire, was first noted in a British Gas survey in 1976. An oval ditched enclosure was revealed of around three acres in area. The main occupation dated from the fifth to the second century BC (Neal 1980: 91, 125), which yielded a moderate assemblage of 1555 animal bones. A high number of dog bones were found, most of which came from two ABGs (Locker 1980: 123).

Suddern Farm

Excavated in 1991 and surveyed further in 1996, Suddern Farm was initially discovered from the air in 1976. Located in Middle Wallop, Hampshire, the site was only 3km from the hillfort at Danebury and included in the wider Danebury Environs project. (Cunliffe and Poole 2000a: 11-15, 53-56). It consisted of a large treble-ditched enclosure around 210m in diameter, which was occupied throughout the Iron Age and Roman periods. Most animal bone remains, including the majority of dog bones, date to the Iron Age phases however (Hamilton 2000a: 175-177).

Nettlebank Copse

A series of enclosures, found in Wherwell Parish, Hampshire, made up the site of Nettlebank Copse. Initially identified from the air in the early 20th century, the site was noted to include an oval 'banjo' enclosure, with 50m ditched corridor leading to the main enclosure area. Included within the Danebury Environs Project, the site was excavated in 1993 onwards. Settlement first began in the Neolithic, although the main period of occupation began in the fifth and fourth centuries BC (Cunliffe and Poole 2000b: 9-12, 49-51). The site was temporarily abandoned in the third and second centuries, then reoccupied in the Late Iron Age and Early Roman periods. Faunal remains were fairly common in both phases, but most dog ABGs dated to the Early Iron Age (Hamilton 2000b: 101-104, 109).

Houghton Down

Another substantial settlement within the Danebury Environs landscape, Houghton Down was located on Chatgrave Hill in Hampshire. Initially the site was surveyed and excavated for potential Roman remains in the early 20th century, but found a large Iron Age enclosure beneath. The settlement began in the Early Iron Age c.800BC, was temporarily abandoned in the middle of the period, only to resume in the Late Iron Age (Cunliffe and Poole 2000c: 11-17). Animal bones were found in both phases, although most dog bones and ABGs date to the later part of the Early Iron Age (Hamilton 2000c: 131-133).

Data Issues

Collecting and recording the ABGs came with several issues, ranging from trivial to challenging. The first, and least significant issue occurred during recording. A few specimens were initially assumed to have elements from different anatomical areas (e.g. head, trunk and limbs), but during recording, this was not always found to be accurate: they were only from one area. In the two cases this occurred, the recording was completed as the elements present were considered to provide useful data. Mixed deposits of ABGs presented another recording challenge. If they could be reliably separated into single ABGs, using clear differences in preservation and size to assist, then they were documented. If not, the deposit was left out of the dataset: two mixed bags from Owslebury and Greyhound Yard were not recorded for this reason. At least eight of the 85 total ABGs came from mixed deposits.

A greater problem was confusing or incorrect contextual data. This was a particular problem in Owslebury, as the context system had changed at an unspecified point in time. What was most puzzling was how the descriptions of dogs in reports sometimes varied from the dogs collected and recorded. Recording systems used in the report were also sometimes different to the systems used on the archive boxes. In these cases, best judgement was used to determine if this was due to analyst mistakes/interpretations or mislabelling of the specimen. This affected Baldock particularly badly, and led to the entire batch of dogs being phased according to the broad site chronology. Another example is the dog at Little Somborne: the report described a dog of different size to the one examined by me, with different elements present and different pathology. The ABG was labelled as broad Iron Age (according to the site it came from) to avoid incorrect phasing, as it was likely mislabelled.

While the details about deposits where ABGs were found, and the presence of other animal bones, were noted where possible, this cannot be used in further analysis. Even highly detailed bone reports were often vague about the deposition context of every dog beyond broad context type, such as pit or well, and were unable to ascertain if the dog was buried alone or with other bones and material goods. Other parts of the report were often unable to fill this gap, and frequently omitted the burials in their descriptions and plans of particular contexts or even placed them in the wrong context.

3.1.2. Secondary Data

The secondary data came from four different sources:

1. *The Roman Rural Settlement Project:* contained data from Late Iron Age to the Late Roman period. Sites included various types of Roman rural settlement, including farmsteads, villas, nucleated settlements, industrial and religious sites. Collected from the version released in 2017 and additional dataset for Defended Small Towns in 2018.

2. *Hambleton's (2008) database of Iron Age sites in Southern England:* collected data from Early Iron age to the Early Roman period.

3. *Albarella and Pirnie's (2008) database of sites from Central England:* while the data ranged from the Palaeolithic to the Post-Medieval, the data collected spanned the Early Iron Age to the Late Roman period.

4. *Other:* collected directly from reports, both published and grey (grey literature came mainly from the Archaeological Data Service and Ancient Monuments Laboratory reports). See Appendix E for sources.

As it was the largest and most comprehensive, the Roman Rural Settlement Project (RRSP)'s data was selected as the core source. The other sources were used to fill in gaps lacking from the RRSP data, particularly Iron Age and larger Roman urban sites. The minimum NISP required per site for recording from the latter three databases was 400. This was chosen to avoid the issue of skewed representation that too small a dataset may bring and also matched Hambleton's database, which had a minimum fragment count of 400. When comparing data from different sources, the RRSP data was standardised to match this requirement.

The Roman Rural Settlement Project collected the following data for each chronological phase per site:

- Total number of Identified Specimens (NISP).
- Dog NISP.
- NISP for all other animals, including both other domesticates and wild animals.
- Total number of ABGs.
- Number of dog ABGs.
- Number of ABGs for other animals.

The data collected from other sources did not include NISP and ABG numbers for other animals, but was otherwise identical to the RRSP data. However, as comprehensive as the RRSP data and the other databases may be, they are not infallible. There was a risk of missing key Iron Age and Roman sites. To mitigate this possibility, a manual search of published and grey literature was also undertaken of Roman sites, in order to identify missing key sites. This proved that the databases were very comprehensive, missing only a few Roman settlements. These were added manually to the database. Late Iron Age to Late Roman rural sites were selected as the focus for cross-species analysis, due to ease of collection from the RRSP.

Dataset Summary

Appendix E comprises the full database. The total number of sites to be analysed is 412, with 900 chronological phases. The latter consists of the total NISP within a site that were dated to a specific phase, following the RRSP format outlined above. For instance, the site Derby Racecourse has 845 bones and 2 phases, of which 398 belong to the Early Roman phase and 447 to the Late Roman. I use the term 'site phase' to describe these throughout.

These numbers may change very slightly for sections in Chapter 5 as some contexts have some data missing, e.g. NISP counts and region are noted, but phase is not. The regions analysed encompass the whole of England. Wales was not included, due to the lack of data and unique cultural considerations compared to the rest of England (albeit hardly unified in of itself): the only exception being a few sites on the Welsh border that were included in the RRSP's data under the 'Central Belt' region. Most sites came from the RRSP (see Table. 3.2), followed by my own data and Albarella and Pirnie's database. The RRSP Defended Small Towns data was the smallest dataset, albeit valuable for adding to the urban dataset. The total number of sites for each data source added up is slightly higher than the main total at 418. This is because several sites were covered by more than one source. As the RRSP data did not record Early or Middle Iron Age data, another source was used for sites that spanned both the earlier Iron Age and Roman periods.

	No. Sites	**No. Site Phases**
Albarella & Pirnie	66	98
Bellis	78	188
DSTRB	17	37
Hambleton	60	95
RRSP	197	482

Table 3.2. Number of sites and site phases by data source.

Data Issues

Not all regions are represented evenly in the secondary dataset. This is due to a relatively complex mix of factors, including but not limited to variable levels of excavation and taphonomic factors. While acidic soils may be found across Britain, several regions, the South West and North in particular, may be a lot more vulnerable to poor preservation (UK Soils Observatory 2019). These regions were also affected greatly by less dense Roman settlement and smaller amounts of excavation (as discussed earlier).

There may be more Roman, particularly Roman rural, sites than Iron Age in the dataset as the Roman Rural Project's data collection is an exhaustive list collected over several years. While intended to be as thorough as possible, the author's own data collection of Iron Age material cannot be as comprehensive due to time constraints; the project required substantial time for the primary data collection and analysis. In addition, many hillfort sites have inadequate amounts of bone data for inclusion in the analysis. Even the Roman data is slightly uneven in distribution: there is a large drop in sites during the Middle Roman period in both the RRSP data and the author's own searches. This is most likely due to less secure phasing to this period. Many reports divide the Roman data into only two phases instead of three, whether by necessity or choice.

3.1.3. Texts

Classical texts were largely obtained from the Loeb Online collection. This allowed for the search of all available translated texts in the Roman world from the Late Republic onwards, including both Latin and Greek texts (as many Roman authors wrote in Greek, and Greek authors lived within the Roman world by this point). Texts before this date were not usually incorporated due to time constraints and the dwindling likelihood of their influence during the time of the Roman annexation of Britain; a select few were recorded due to their importance and impact on later works. For instance, Xenophon's *On Hunting (Cynegetica)* is a Greek text written c. 430-350 BC, but it is widely used and referred to in later Roman works on hunting. As contextual understanding is essential in textual analysis, commentaries of key texts and passages will be incorporated. They may offer insights that the less expert reader may miss, such as Martial's epigram of the dog Issa being written as a parody (Fleck 2008).

Even within this time period, the range of texts is enormous. Therefore, texts to be flagged for further reading and analysis have been included on the basis of informing attitudes towards dogs and/or their husbandry and care; this may include both fictional and non-fiction texts of various genres. Texts pertaining to Britain have also been prioritised for study. There are many miscellaneous references to dogs in mythology, but although these may inform attitudes indirectly, the in-depth study of mythology is beyond the scope of this thesis.

3.2. Methods

To analyse even a single dog, we must use many different recording *and* analytical techniques. As the methods vary in their complexity and the amount of information they yield, here I will outline each one used. Methods are adopted from other authors where suitable, but the specialised nature of the project has made it necessary to develop several original methods or refine existing ones.

The data provided, when aggregated, will be comprehensive enough to create a biography for each individual dog, both pre- and post-death. The process of creating animal biographies is a key aim in of itself, but they are also used in this project to answer the other research questions.

3.2.1. A Skeletal Inventory

A full skeletal inventory is key for ABG analysis, particularly for pathology and deposition. If it is not taken, it will be unknown if a low prevalence of lesions are due to poor ABG/part of ABG survival or genuine lack of pathology. In order to ensure every bone was noted in the inventory, the osteology section of Miller's *The Anatomy of the Dog* was used as the basis (1964: 1-94). See Fig. 3.2 for a full diagram of the canine skeleton, and Fig. 3.3-5 for diagrams of the smallest bones.

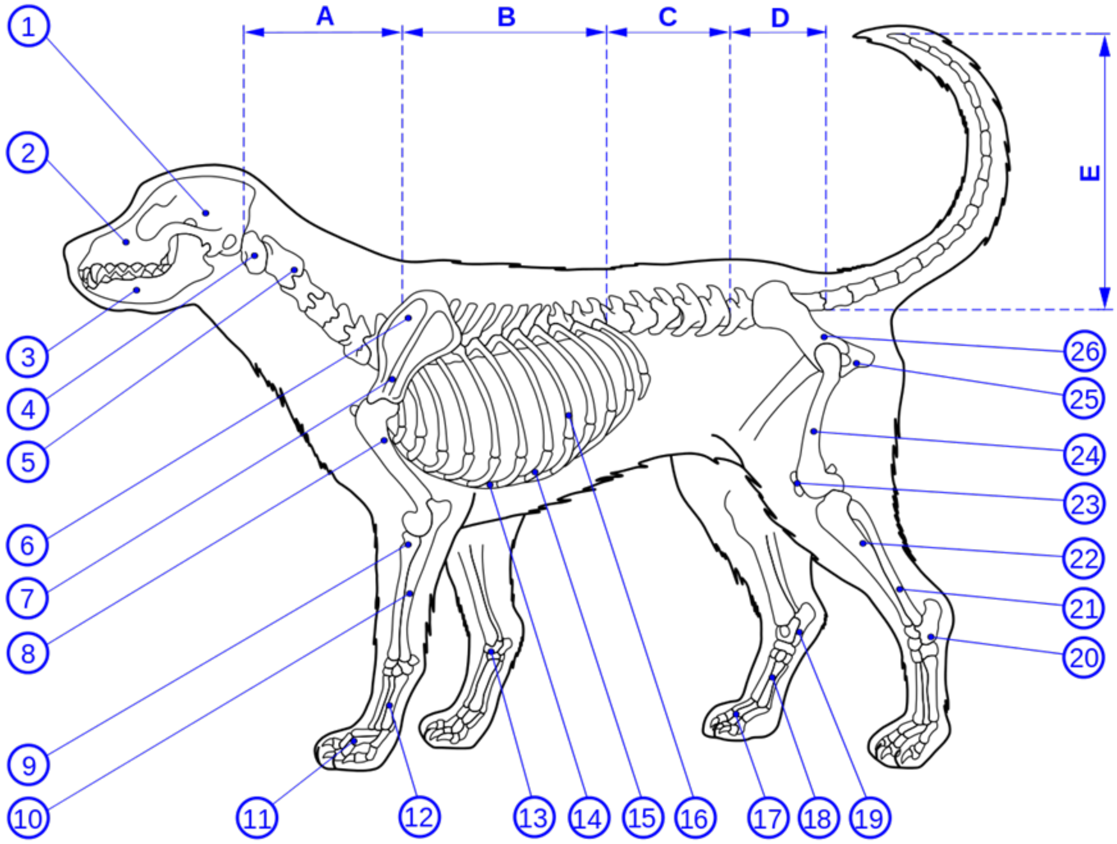

Fig. 3.2. Diagram of canine skeleton with all major bones labelled (see below; Maksim 2013).

Key

A – Cervical or Neck Vertebrae (7 in number).
B – Dorsal or Thoracic Vertebrae (13 in number, each bearing a rib).
C – Lumbar Vertebrae (7 in number).
D – Sacrum
E – Caudal or Tail Bones (number varies).
1 – Cranium or Skull.
2 – Maxilla.
3 – Mandible or Lower jaw.
4 – Atlas.
5 – Axis.
6 – Scapula or Shoulder blade.
7 – Spine of scapula.
8 – Humerus.
9 – Radius.
10 – Ulna.
11 – Phalanges.
12 – Metacarpal Bones.
13 – Carpal Bones.
14 – Sternum or Breast bone.
15 – Cartilaginous part of rib.
16 – Ribs (13 in number).
17 – Phalanges.
18 – Metatarsal Bones.
19 – Tarsal Bones.
20 – Calcaneus (os calcu).
21 – Fibula.
22 – Tibia.
23 – Patella, or Kneecap.
24 – Femur.
25 – Ischium.
26 – Pelvis or Hipbone.

(Adapted from Maksim 2013)

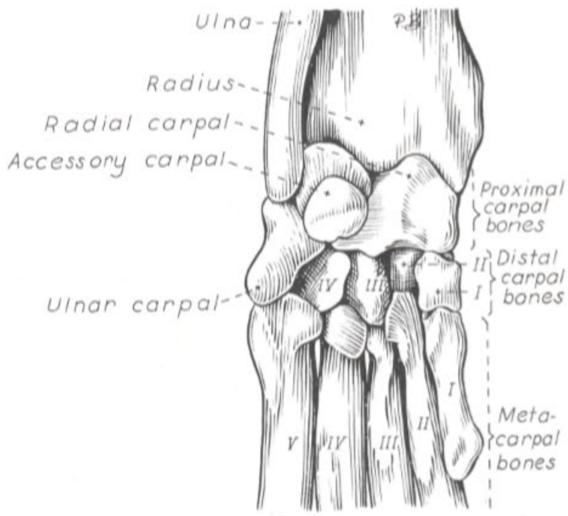

FIG. 1-75. Left carpus, articulated, palmar aspect.

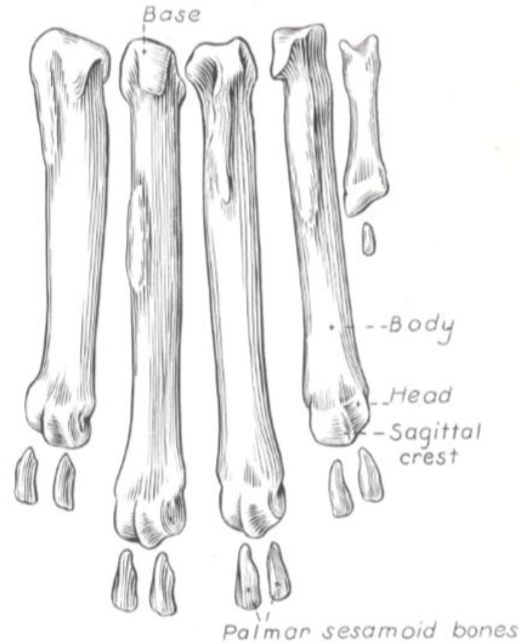

FIG. 1-77. Left metacarpal and sesamoid bones, disarticulated, palmar aspect.

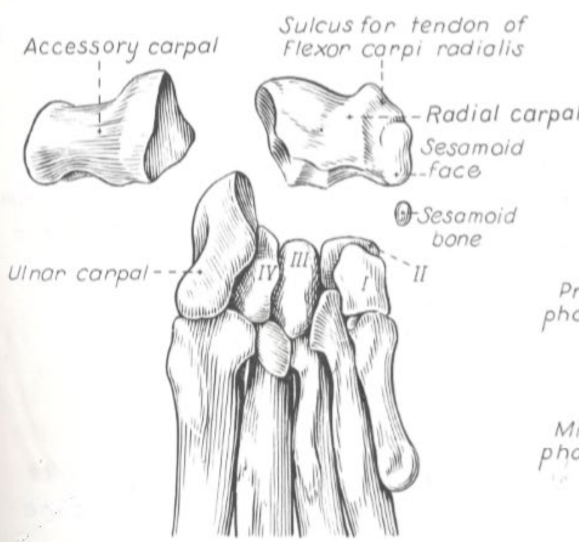

FIG. 1-76. Left carpal and metacarpal bones, palmar aspect. Radial and accessory carpals disarticulated.

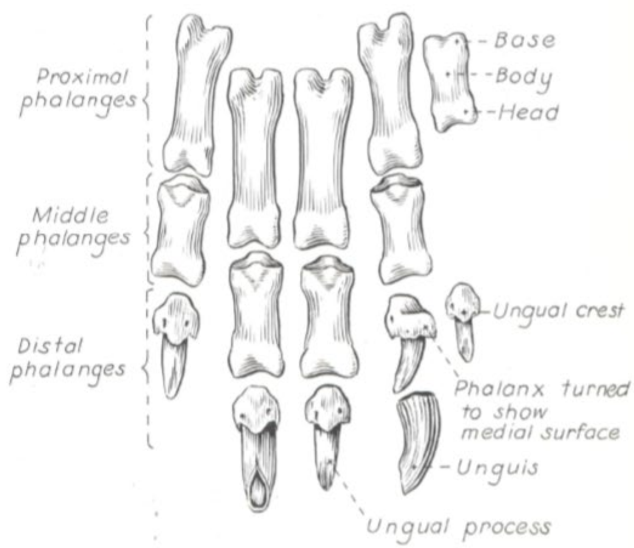

FIG. 1-78. Phalanges, disarticulated, palmar aspect.

Fig 3.3. Detailed diagram of the front paws and carpals (Miller et al. 1964: 77).

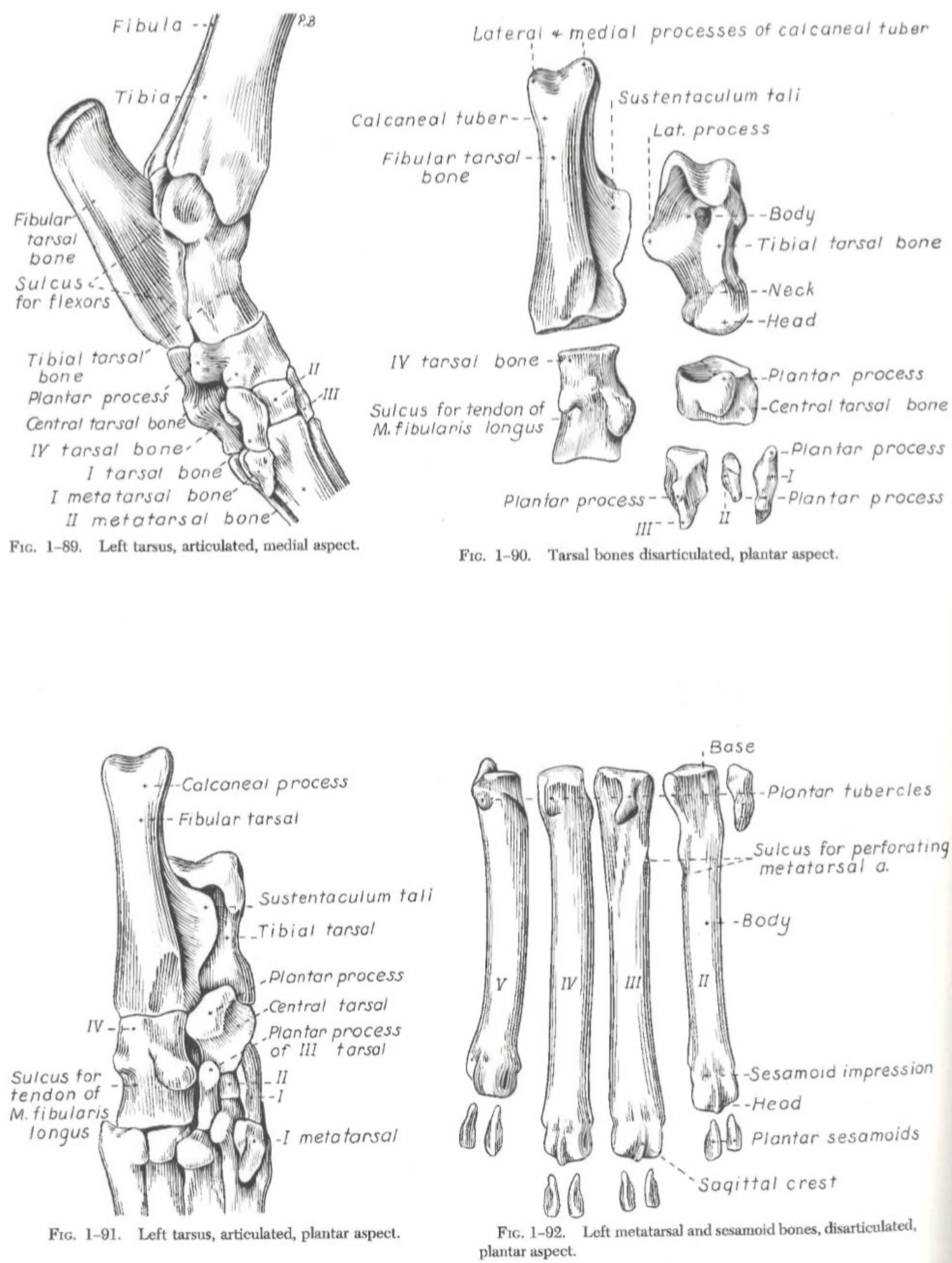

Fig. 3.4. Detailed diagram of the back paws and tarsals (Miller et al. 1964: 90).

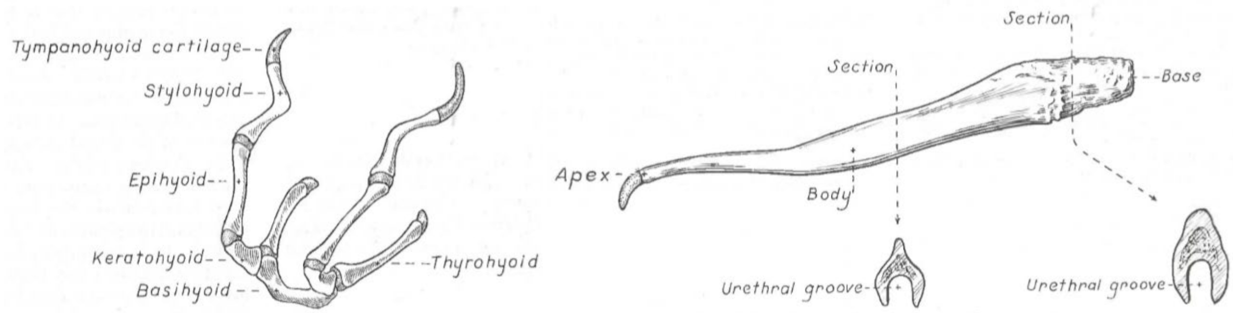

FIG. 1-31. Hyoid bones, anterior lateral aspect.

FIG. 1-97. Os penis, lateral aspect, with cross sections.

Fig. 3.5. Detailed diagram of other small bones not visible on 3.2; hyoid and baculum (otherwise known as os penis; Miller et al. 1964: 37, 93).

The specific terms for many of the small carpal and tarsal bones vary according to publication. For instance, the 'fibular tarsal' in Fig 3.4 is also named the 'astragalus' and 'talus' elsewhere (e.g. Schmid 1972). In this inventory I have chosen the use of 'radiale' in place of 'radial carpal', 'ulnare' in place of 'ulnar carpal' and 'pisiform' for the' accessory carpal'. For the tarsals, 'talus' is used for the 'tibial tarsal' and 'calcaneus' is used in place of 'fibular tarsal'. These terms are also commonly used in osteological publications (e.g. Kardong 2001: 332). The inventory recording sheet and form both have limited space (see Appendix E), and so the shortest terms are necessary to fit.

Bones that were excluded from the count include the carpals I and II and tarsals I and II. This is because they are extremely small in dogs, and very easily missed by the excavator, post-excavator and/or the analyst (particularly in very fragmented bags). They are also so small they are near-impossible to assign to the left or right side. The hyoid bones also present issues: the stylohyoid and basihyoid have a distinctive curved shape that is easy to identify, but the others are more likely to be missed or mistaken for other bones during recovery, and thus the entire hyoid is unlikely to be found. To counteract this issue, the general presence or absence of any hyoid bones will be noted.

The method for judging survival of larger bones was based on Serjeantson's zoning system, supplemented by Mahoney's system for the mandibles. This divides each bone into 8 separate zones, and a zone is either recorded as present or absent (assuming it is at least 50% present; see Figs. 3.6 and 3.7). Only long bones, mandibles, scapulae and the pelvis were zoned, as zones for vertebrae and ribs generate little useful data. The metapodial zones in Fig. 3.6. are based on those from large ungulates and were not used.

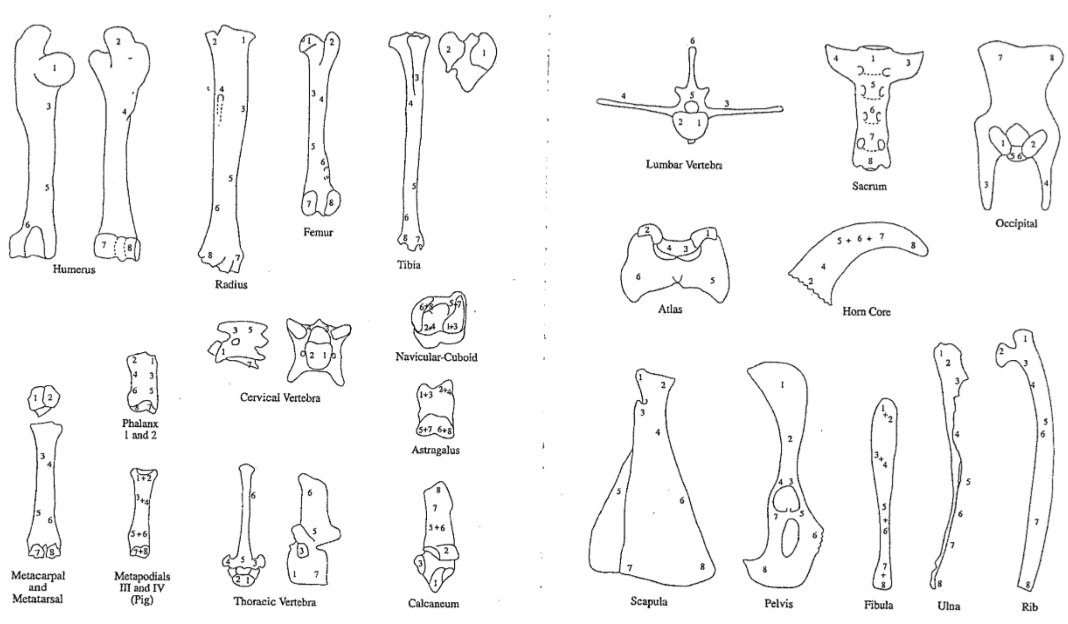

Fig. 3.6. Serjeantson's system for zoning elements (1986: 196-197).

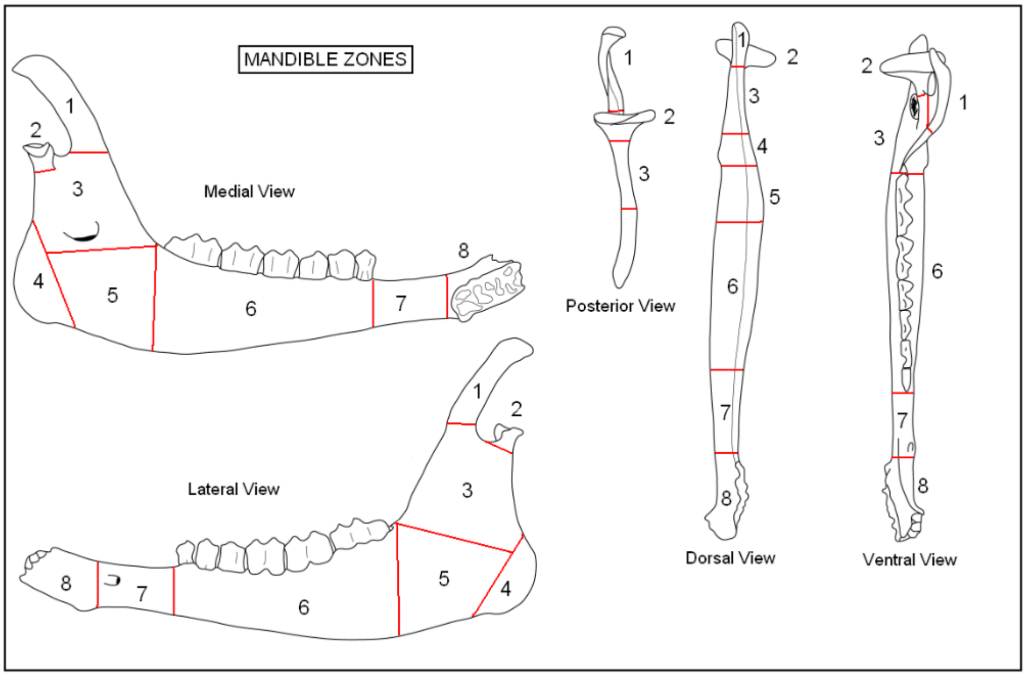

Fig 3.7. Mahoney's system for zoning mandibles (2016: 308).

Serjeantson's system does not include zones for the skull. While a zone system has been developed by Mahoney (2016: 308), most of the crania in this data were too fragmented to be sorted into zones. A series of stages, more appropriate for this data, was developed to measure completeness:

0	Skull absent
1	Few small fragments present
2	Many small fragments present or couple of larger fragments
3	Numerous small or several large fragments present
4	Skull mostly intact aside from bone or two
5	Skull fully intact

The final inventory is as follows:

Skull (staged)
Mandibles (zoned)
Scapulae (zoned)
Pelvis (zoned)
Atlas (presence/absence)
Axis (presence/absence)
Sacrum (presence/absence)
Cervical vertebrae (count)
Thoracic vertebrae (count)
Lumbar vertebrae (count)
Caudal vertebrae (count)
Sternum (presence/absence)

<u>Long Bones</u>
Humerus (zoned)
Radius (zoned)
Ulna (zoned)
Femur (zoned)
Tibia (zoned)
Fibula (presence/absence)

<u>Paws, Joints and Misc</u>
Metacarpals I-V (presence/absence)
Radiale
Ulnare
Pisiform
Carpal III
Carpal IV

Metatarsals II-V
Calcaneum
Central
Tarsal III
Tarsal IV

Hyoid (presence/absence)
Costal cartilage (presence/absence)
Patella (presence/absence)
Baculum (presence/absence)
Sesamoids (presence/absence)

Dental Inventory

Unlike humans, adult dogs have 42 teeth. However, their maxilla has two less teeth than the mandible: it has two upper molars, not three (Fig. 3.8).

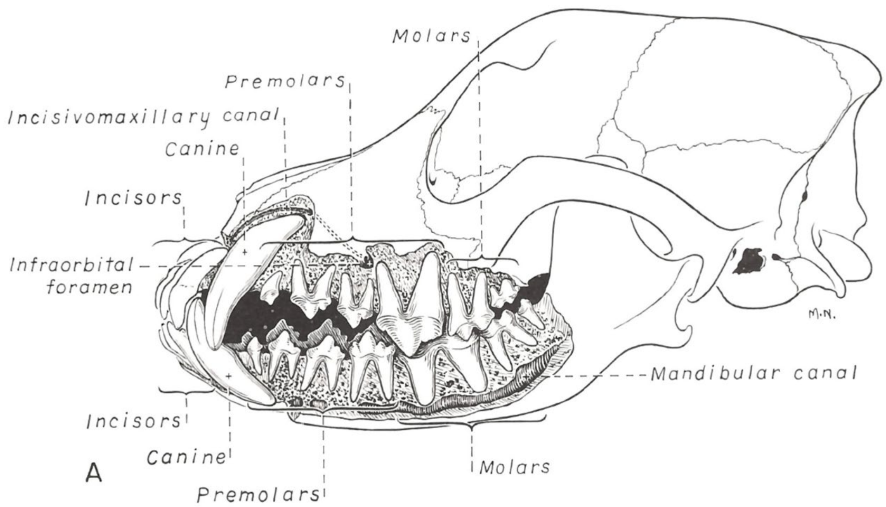

Fig. 3.8. Diagram of full set of adult dog teeth (Miller 1964; 650).

Each tooth was recorded individually, using the following system to indicate its status:

P	Present in mandible/maxilla.
L	Present, but loose tooth with part of mandible/maxilla with its alveolus (tooth socket) missing.
E	Tooth present in mandible/maxilla, but not fully erupted.
PM	Tooth present, but found loose. Probably lost post-mortem due to presence of alveolus in mandible/maxilla.
AM	Tooth missing, probably lost ante-mortem during life of the dog. Judged by infilling of alveolus that occurs after tooth loss in live animals.
CA	Tooth absent, and alveolus for tooth missing. Judged to be congenitally absent rather than lost post-mortem, usually due to lack of corresponding gap between teeth or teeth and jaw for alveolus.
NP	Not present. Rarely used category to denote teeth in puppies that have not yet erupted, but are expected to.

For the first molar, or M1, a separate wear category was created using criteria in 3.2.1.

3.2.2. Judging Completeness

Once the inventory is recorded, it is necessary to judge the completeness of each ABG, so they may be compared against one another. There are several ways in which this may be done:

Total bone count: Counting each bone, with exception of the ribs and baculum. This is the simplest method, but the least representative of the useful data that the ABG may generate. A bone count may be very high due to presence of such as the vertebrae, joints and paws, but lack the more substantial elements such as the long bones and mandibles.

Completeness by anatomical area: The skeleton is divided into five anatomical areas, which are then scored separately from one another. Each element in an area makes up a certain percentage of the total: smaller, less dense and less common elements make up a smaller percentage than larger and more dense elements.

Completeness will be ranked by an overall percentage score and a percentage score for each area. The categories are as follows:

<u>Skull (20% of total)</u>
Cranium (Stage number x 10%)
Left and right mandible (25% each)

<u>Trunk (25% of total)</u>
Left and right scapula (7.5% each)
Left and right pelvis (7.5% each)
Atlas (5%)
Axis (5%)
Sacrum (5%)
Cervical vertebrae (13% total)
Thoracic vertebrae (13% total)
Lumbar vertebrae (13% total)
Sternum (2%)
Hyoid (2%)

<u>Paws (15% total)</u>
Left and right metacarpals I (2% each)
Left and right metacarpals II-V (4% each, 32% total)
Left and right metatarsals II-V (4% each, 32% total)

First phalanges (11% total)
Second phalanges (11% total)
Third phalanges (10% total)

<u>Joints (15% of total)</u>
Left and right radiale (5% each)
Left and right ulnare (5% each)
Left and right pisiform (5% each)

Ribs (12% total)

Long Bones (25% of total)
Left and right humerus (10% each)
Left and right radius (10% each)
Left and right ulna (7.5% each)
Left and right femur (10% each)
Left and right tibia (10% each)
Left and right fibula (2.5% each)

Left and right carpal IV (2.5% each)
Left and right carpal III (2.5% each)

Left and right talus (5% each)
Left and right calcaneum (5% each)
Left and right centrale (5% each)
Left and right tarsal IV (2.5% each)
Left and right tarsal III (2.5% each)

Left and right patella (7.5% each)
Sesamoids (at least one; 5%)

I developed these categories in order to provide an indicative assessment of completeness beyond a simple numerical count. Each percentage reflects the relative proportion that the bone (represents in the area). Larger, less numerous bones were assigned a larger percentage than smaller, more numerous elements.

The joint category was designed as a way to measure the survival of the very smallest bones in the limb joint areas, particularly the small carpals and tarsals bones between the long bones and the paws. The category comprises primarily carpals and tarsals, but also the sesamoid bones (including the patella, the largest sesamoid bone that is unique to the kneecap). While the latter are not joint bones in of themselves, they are nonetheless found in tendons surrounding the carpal, tarsal and other limb joint areas where they provide support (Allan and Davies 2018: 407). Because the bone is very small and variable in number between dogs, I have included a flat count of 5% counted if at least one sesamoid is present.

For the zoned elements, a further level of scoring is added: each zone present represents 1/8 of the element. So, for instance, if half of the zones for the radius are present, then the element would be scored at 50% of its value if it were complete. This is 5%. Only 2 zones surviving would be 2.5%, and so on. For the vertebrae and phalanges, the percentage refers to the total if all are present. Otherwise the percentage is a proportion of the total: e.g. 7 of 14 first phalanges would be 50% of the total, at 5.5% overall. The ribs, being very difficult to quantify accurately (due to fragmentation), are given the following scores: 1-10: 4%, 11-20: 8% and 21+: 12%. This allows for the approximate level of rib survival to be quantified.

Completeness by survivability: Each element is ranked, based on how often it generally survives. This is informed by a combination of density (Lyman 1994) and recoverability based on size. Large, dense bones, such as the humerus and mandibles are ranked as high survivability. The smaller and less dense a bone is, the less survivable it is rated. The three categories are:

High survivability: Mandibles, all long bones except for the fibula.
Medium survivability: All vertebrae, scapulae, metatarsals and metacarpals (except metacarpal I).
Low survivability: Phalanges, carpals and tarsals, hyoid, sternum, metacarpal I and fibula.

In each category, the percentage of bones that survives is calculated by dividing the sum of all bones present (or zones present in the case of zoned elements) by the maximum. The only exceptions are the ulna and scapula. These do not survive consistently due to variable density across the bone (Lyman 1994: 238-248) and the fragile distal zones, particularly in the scapula where Zones 5, 6 and 8 are made up of very thin bone. Zones 1-4 are of medium survivability for both elements, but the remainder is more fragile, rarely surviving completely intact. In these cases, only zones 1-4 will be counted. The skull has been excluded as it does not clearly fit into any category. It is very fragile, and prone to fragment, reducing its chances of complete recovery. However, it is likely that at least a fragment or two, particularly around the maxilla, will be recovered.

In order to maximise the useful information gained from the inventory, and to identify differences in completeness between ABGs, all of these methods will be used. If an ABG has only high survivability elements from an even range of body parts, this suggests the taphonomic effects are very different from an ABG with elements from all three survivability categories, but only from specific body parts. Using all of these methods in tandem can be very useful for understanding the taphonomic effects on each ABG, which will be invaluable at the biographical level.

The caudal vertebrae have been omitted from counts of completeness *except* for total bone count. This is because they vary considerably in number between individual dogs: they range from 6 to 23 (Miller *et al.* 1964: 58). It is therefore impossible to quantify how complete the tail is for each ABG: a dog with 5 caudal vertebrae, for instance, may have survived with its tail mostly or barely intact.

3.2.3. Metrics and Measurements

The aim of the metric data was to indicate the general physical size and shape of the ABG, including snout length, height at withers and limb proportions. The selection of measurements has carefully balanced time constraints with an issue raised by Clark: taking the most basic of measurements exclusively may miss other signs of changing physiology across the time period under study (2000: 166-167).

Cranial Metrics

Cranial and mandibular metric data to be recorded are outlined in Figs 3.9 and 3.10. Additional measurements to be included are M1 length and width (from Baxter and Nussbaumer 2009). Lüps' measurements F and G overlap with Harcourt's (see Figs 3.9 and 3.10), so will be omitted to avoid duplication of effort. From these measurements the Cephalic Index (CI), the Snout Index (SI) and the Snout Width Index (SWI) will be calculated (from Harcourt 1974).

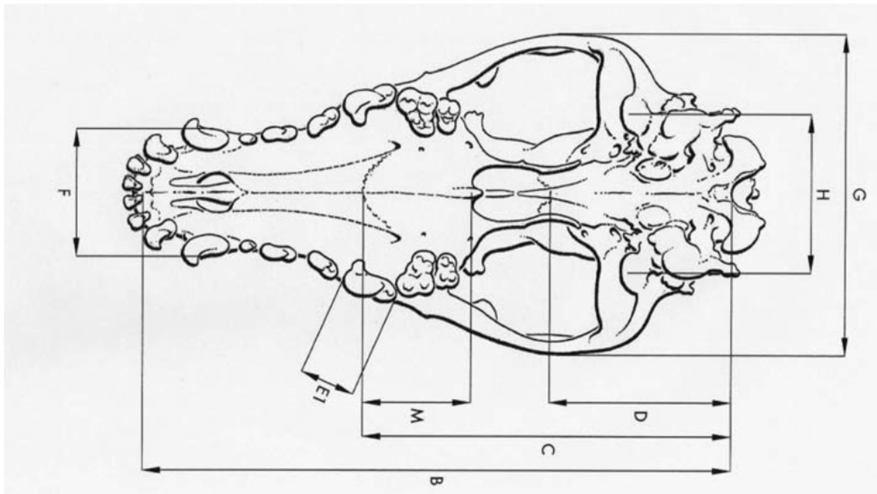

Fig. 3.9. Diagram of Lüps measurements (1974).

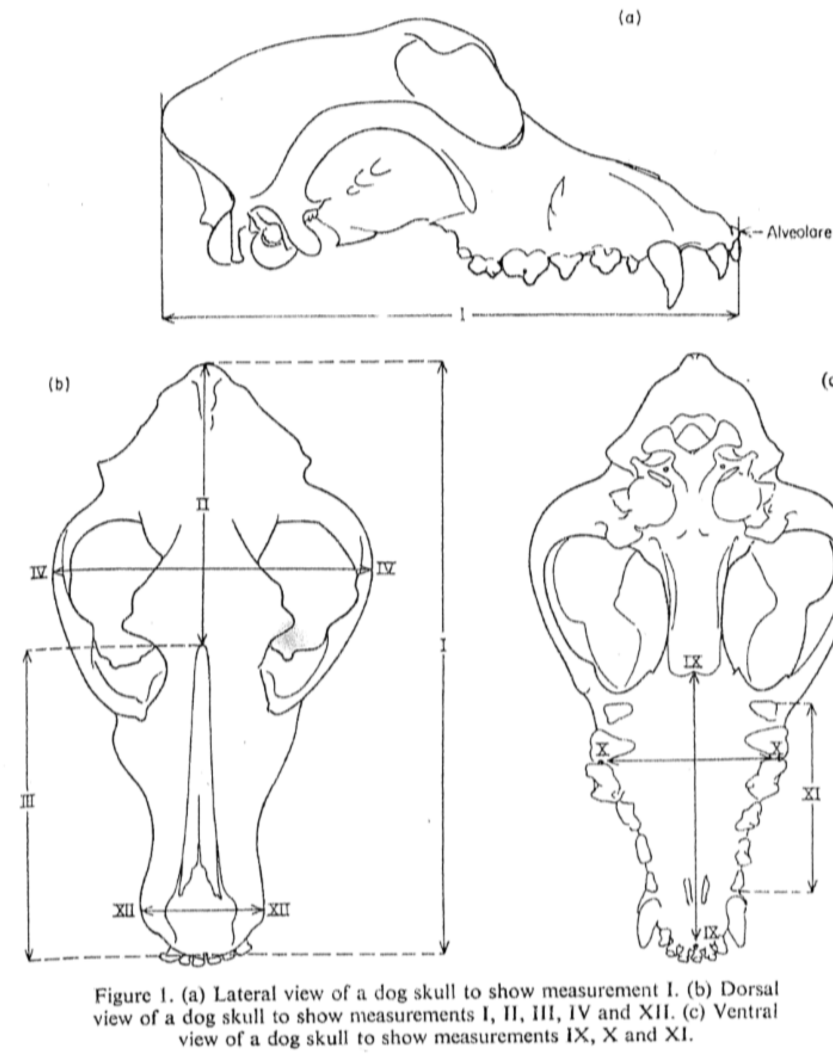

Figure 1. (a) Lateral view of a dog skull to show measurement I. (b) Dorsal view of a dog skull to show measurements I, II, III, IV and XII. (c) Ventral view of a dog skull to show measurements IX, X and XI.

Fig. 3.10. Diagram of Harcourt skull measurements (Harcourt 1974).

Post-cranial Metrics

Limbs will be examined for the following measurements (from von den Driesch 1976):

Gl	Greatest length
SD	Minimum breadth of the diaphysis
Bd	Maximum breadth of the distal end
Bp	Maximum breadth of the proximal end
Dp	Depth of the proximal end (humerus only)

From the post-cranial data, Harcourt's method will be used to calculate shoulder height at the withers and the slenderness index (SI) (from Harcourt 1974: 153 and Grossi Mazzorin and Tangliacozzo 2000: 155-156). This will allow for an assessment of the general shape of the dog. If the index is high, the dog had slender limbs, meaning it was slim and gracile in shape. If it is low, the dog had thicker, more robust limbs; this means it was a broader shape. Intermediate measurements indicate the dog was relatively average in build.

3.2.4. Recording and Analysing Pathology

Pathology is perhaps the most essential part of this analysis: it can be the most directly indicative of human-animal relationships, particularly during the life of the animal. Lesions will be recorded descriptively using a modified version of Vann and Thomas' system (2006; see Table 3.3); criteria have been altered slightly for dogs. Each element was examined for pathology, and sorted into the following categories:

Category	**Recorded**	**Sub-Type**
Bone Formation	Size, extent, shape, margin	Extension of Bone Ridge Periostosis Osteophyte Enthesophyte Callus Ankylosis (fusion) Other
Bone Destruction	Size, extent, shape, margin, interior, sclerosis	Cavity Porosity Osteopenia Articular Depression Articular Destruction Articular Groove Cloaca Necrosis Hypervascularity Other
Fracture	Condition, angle, foreshortening, compound	Transverse Comminuted Oblique Hairline Impacted Incomplete Spiral Greenstick
Alteration of Size		Enlarged Reduced
Alteration of Shape	Angle, direction	Bowing Diaphyseal Expansion Metaphyseal Expansion Articular Extension Displacement Thickening of Epiphyseal Plates
Other		Failure to Form Bone Eburnation Indicators of Care Other

Table 3.3. List of pathology categories, sub-types and features to be recorded (adapted from Vann and Thomas 2006).

Oral pathology will be recorded using different categories:

Type	**Measurement**	**Details/Stages**	**Source (for stages)**
Cavity	Abscess Stage	Low grade infection (1) Medium grade infection (2) High grade infection (3)	Levitan 1985: 45
	Caries Type	Caries Pulp Cavity Exposure	
	Caries Stage	1-8: from least to most severe. Complex system depending on caries type; see Hillson for details.	Hillson 2005: 298
Tooth Wear	Attrition	Mesial Attrition Distal Attrition Medial and Distal Attrition	
	M1 Wear	A-G: see source for picture.	Horard-Herbin 2000
Enamel Hypoplasia	Type	Pit Plane Line	
	Other	Measurement from cemento-enamel junction (mm)	
Periodontal Disease	Calculus	Presence	
	Alveolar Recession Stage	Recession of alveolar margin only (1) More recession, alveolus widened post-mortem (2) Ante-mortem tooth loss and alveolus infilling (3) Infilling advanced but not complete (4) New bone formation nearly complete (5)	Synthyses database (unpub.) adapted from Brothwell 1981: 155
Abnormal Teeth	Supernumary Teeth	Location	
	Absent Teeth	Congenital Ante-Mortem Post-Mortem	
	Tooth Rotation	Angle	
	Tooth Displacement	Lingual Labial Mesial Distal	
	Anomalous Crown Height	Higher Lower	

Table 3.4. List of oral pathology categories, sub-types and features to be recorded (adapted from Vann and Thomas 2006).

A basic overview of pathology, per ABG, may be obtained from the biographies in Appendix A. Detailed information, including differential diagnosis in several unusual cases, is available from the database in Appendix E, and photographs of unusual pathology (sorted by ABG) are outlined in Appendix C.

3.2.5. Ageing Dogs

The ageing of dogs is difficult relative to other domestic animals. A dog's adult dentition erupts relatively early and all bone fusion is complete by two years; ageing up to this point will be done using the data from Silver (1963). Ageing after this time, via dental wear, which is well established in the ageing of cattle, pigs and horses (Grant 1982), is more difficult in dogs due to the structure of their teeth and their diet, which may vary.

However, the dental results must be treated with caution and compared to fusion data wherever possible. In modern breeds, there is a great deal of variation in the timespan when dogs reach maturity. Smaller dogs usually mature more quickly than this average and particularly large dogs more slowly (Geiger *et al.* 2016: 3-4; Hawthorne *et al.* 2004: 2029S). While the Roman period is unlikely to have had breeds as established in the present day, it shows a great deal of variation in dog size and this variation in reaching physical maturity will almost certainly have been present then.

I will use an adapted version of Horard-Herbin's method, which ages dogs according to wear on the mandibular first molar (stages A-G, from least to most wear; Horard-Herbin 2000: 117). As the age stages outlined in the original paper do not fully match the ageing data, which found adult dogs with dental wear of stages A-C and older dogs (with age-related pathology) with wear stages of F, they have been modified. Stages A-E will indicate a young adult, assuming the postcranial skeleton is fused, and F-G an older adult. While a technique for ageing dogs according to incisor wear has been developed by Pierard (1972), I found that these teeth were usually absent or found loose.

Non-adult domestic animals are typically sorted into age categories: infant/newborn, immature, juvenile and subadult (Greenfield 1988: 574; 2005). While the same groups are not typically used for dogs, they correspond well with the three stages of fusion (cf. Silver 1963) and will therefore be adapted for collecting data. As there is a huge amount of variation in the exact ages at which dogs mature (ranging from one year to more than two), these descriptive age categories are a better fit than categories defined strictly by age, which are far more likely to be inaccurate. The criteria for each age group is as follows:

Foetal	Proximal phalanges unfused.
Newborn	Deciduous teeth erupting.
Immature	Deciduous teeth erupted and/or early stage unfused.
Juvenile	Early stage fused, middle stage unfused.
Subadult	Middle stage fused, late stage unfused.
Adult	Late stage fused.
Young Adult	Late stage fused, with M1 wear at Stage A - E.
Older Adult	Late stage fused, with M1 wear at Stage F - G, and/or pathology associated with age.
Unknown	No fusion data available, or cannot be organised into above category.

In some instances there may be insufficient evidence for placing an ABG in any one group. For instance, if it contains several early stage elements that are fused, but no other bones (fused or unfused), the ABG may potentially be juvenile, subadult or adult. Therefore, the ABG will be classified as 'Unknown' unless there is very heavy dental wear or pathology that occurs with advanced age.

3.2.6 Determining Sex

It is very challenging to work out the sex of a dog. Even though the baculum, or penis bone, is a definite marker a dog is male, it is fragile and rarely survives in ABGs. Unlike many ungulates (Greenfield 2006), the pelvis has little to no difference between male and female canines; this is due to the fact that they give birth to litters (known as multiparity) rather than single offspring.

I opted not to determine sex using the basialoccipital part of the skull (The and Trouth 1976; Trouth *et al.* 1977), as occipital rarely survived in sufficient condition to be usable. Another method not used is the 'table test' outlined by Ruscillo (2006). While simple to carry out, it is rather inaccurate: in the original paper, the dog's sex was incorrectly estimated 15% of the time when the humerus fell over and in 31% of instances when the humerus remained on its side (Ruscillo 2006: 63-64). Only 41% of ABGs in this dataset had at least one complete humerus, some with pathology. Of these humeri, many were also unusual shapes, particularly in individuals with chondrodystrophy (dwarfism; see Chapter 6). The effect of this shape change on results is unknown.

A more complex, but potentially more accurate method is the use of Shigehara's discriminant functions, based on measurements for select anatomical regions (1997: 113-125). However, there is a potential drawback to this method. It was developed based on Shiba Inu dogs, a breed that originated in Japan some time before the 19th century. An adapted version of the functions was made for ancient Jomon era dogs, also from Japan (Shigehara *et al.* 1997; 125). While I recorded the specified measurements and calculated the discriminant functions for my dataset (Appendix D), the results were poor. Both the original functions and the adapted functions yielded extreme positive and negative values that changed dramatically between original and adapted functions, to the point where each stated the dog to be a different sex. Thus, the method is probably unsuitable for genetically and physiologically heterogeneous populations. Ultimately, the only animals that could be reliably sexed were dogs with a baculum.

3.2.7. Other Attributes: Butchery, Gnawing and Preservation

Several other attributes were recorded: butchery, gnawing and preservation. Each may help flesh out how a dog was treated after it died. For each instance of butchery on an ABG, the element was recorded, as was the type of implement used, length of cut or chop, and the anatomical zone. Gnawing was recorded per ABG, on a simple presence or absence basis: further information on the precise location of gnawing does not contribute any significant information about the ABG. Preservation was recorded following Harland *et al*. (2003).

3.2.8. The Database

In order to capture the results of all the following methods in one place, a Microsoft Access database has been constructed (Appendix D). It contains several linked forms for site data, general information about each dog, skeletal and dental inventories, metric data, butchery and pathology. In addition to recording the outcomes of 3.2.1-3.2.7., the database will note contextual information about each dog. This comprises the following:

- Site information, including location and site type.
- Context and box number for each ABG.
- Chronological phase for each ABG.
- Preservation of each ABG (after Harland *et al.* 2013).
- Presence of carnivore gnawing.
- Additional comments.

Each ABG will be assigned a unique ID number in the database. The format for each ID is simple: the first two/three letters of the site name (or the first letter from each word, where applicable) followed by a number for each dog. For example, OW-5 would denote the fifth dog analysed from Owslebury, and SF-2 the second dog from Suddern Farm. Additionally, each lesion found will be assigned a unique ID number, comprising a unique number for each lesion beginning at 1.

3.2.9. Bringing the Methods Together: The ABG Biographies

As a main aim in the project, each ABG will have a biography created. The biographies will not use every single specific piece of information recorded from the dog set out in Appendix D; instead, they will take the main conclusions from the recording process and present them as a narrative. For instance, the Gl of the humerus will not be mentioned in the biography. What will be noted, however, is the withers measurement derived from this Gl, as this is the useful part of the data.

Each biography will be built using a template based on an Excel spreadsheet. This spreadsheet divides the biography up into two components: pre-death biography and post-death, with the age at death sitting between the two. Just as parts of Chapters 4 and 6 will outline the state of ABG completeness/age/ pathology for the whole population, the biographies will outline the general state of each dog, so the viewer may gain a general impression of their life. For particularly interesting or unusual lives, Chapter 7 will take select ABGs and create a story from the biography.

3.2.10. Statistical Analysis and Key Terms

Patterns in the data were assessed for statistical significance. I use the standard cut-off outlined by Fisher, which is for p-values of 0.05 or less: any values higher than this were not judged to be significant. However, given the somewhat arbitrary nature of this cut-off point (Sterne and Davey-Smith 2001; VanPool and Leonard 2011: 102-105) and paper I found), I occasionally note values slightly above this cut-off when they contrast with very high p-values in pairwise tests (see below). These values indicate potential areas for further analysis.

As the data are not normally distributed, i.e. following a normal distribution, I will use only nonparametric methods that do not assume the data follows a normal distribution. These have less statistical power than parametric methods that assume the data is normally distributed, meaning that they carry a higher chance of falsely assuming no difference is present (VanPool and Leonard 2011: 262). Six tests were used across this project. All testing was conducted using R (version 3.5.2)'s base package, which contain suitable tests for each method:

- Kruskal-Wallis Analysis of Variance (ANOVA). A test for determining significance between groups, variables are ranked both as a whole and by individual groups (VanPool and Leonard 2011: 267-268). The Wilcoxon signed-rank test was used as a post-hoc method to compare pairs of results for significance, e.g. Early and Late Roman samples. To minimise the chance of false positives, p-values were corrected. I chose the Benjamini-Hochberg (BH) correction over another key method, Bonferroni, as the latter may be more prone to false negatives (Diz *et al.* 2011: M110.004374 –3) which may be more of an issue in a lower-powered nonparametric method.

- Spearman's Rank Correlation Coefficient and Kendall's Tau Coefficient. Both test significance by ranking and comparing two sets of variables. Each method generates an additional value alongside the p-value, rho and tau, that measure correlation between the two sets. 1 indicates a perfect positive correlation, -1 a perfect negative correlation, and 0 no correlation at all. Spearman's was used when few or no tied pairs were present, and Kendall's Tau when many ties were found, as it is better equipped to deal with them (Field 2009: 181).

- Chi-Squared Test ($\chi2$), which was used in Chapter 6. The test compares expected values against observed values in categories to see if any observed difference is significant or due to chance (VanPool and Leonard 2011: 240). When sample sizes were particularly small with a substantial number of samples below 4, Fisher's test, which works in a similar way, was used as an alternative.

In addition to statistical testing, box plots will be used in many analyses, particularly Chapters 4 and 5. These charts represent much more information than a basic box or line graph, but are slightly more difficult to interpret due to their complexity. The key values are noted in Fig. 3.11.

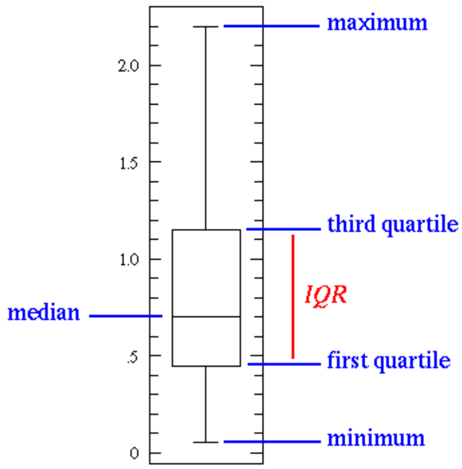

Fig. 3.11. Main values in a boxplot.

The line through the box is the median, the middle value. Two other values that are important are the third (upper) quartile and first (lower) quartile, representing the values at 75% and 25% of the results respectively. Values between these two lines, therefore, represent the spread of results in the middle 50% of the data. Outliers above or below the maximum and minimum are represented with dots. As the data in this project is not normally distributed, the maximum and its outliers will usually be more prominent than the minimum.

3.3. Summary

To summarise, the faunal evidence is composed of two types of data. The first is primary data, collected directly from dog skeletons/ABGs by the author; the second is data collected by other authors on the general prevalence of dog material in England. The latter is, unsurprisingly, much less detailed, but greater in number and broader in range. On the other hand, the primary data focuses on only 85 individuals, but uses the many different analytical methods from 3.1 to construct a biography of each individual ABG for Aim 5. The textual analysis, which is much smaller in scope than the faunal data, relies largely on agricultural and hunting treatises and short passages from other genres. Aside from the occasional sentence or word, I use mainly translated works.

Each thematic chapter will briefly revisit these methods and materials when discussing the data, and signpost to relevant sections: I recommend returning to this chapter to refresh knowledge of the specific methods when necessary. What follows from here are chapters that deal with each aim from the introduction. Before delving into the ABG pathology and constructing detailed biographies, I will first establish the context of how dog numbers changed through time and space.

Chapter 4: Dogs in Transition

The first theme of this project is how human-dog relationships changed through time, particularly between the Iron Age and Roman transition. This is a deceptively simple aim: it is easy to confuse difference between regions and different settlement forms with genuine transition through time. Therefore, I will investigate variation in overall dog numbers, and relative proportions, across the entirety of England before focusing on the smaller primary dataset from the Southeast and East. Texts will be used to help place these changes in a wider context, particularly as Britain had significant interactions with the Continent before the Roman invasion (Cunliffe 2005: 126-128).

Previous scholarship has tended to focus on single (unusual) case studies for dogs (cf. Baxter, 2006; MacKinnon and Belanger 2006), analysis of metrics or ABG numbers through time (Clark 1995; 2000; Harcourt 1974; Morris 2008; 2010; 2011). Numbers of cattle, sheep and pigs have been compared against one another throughout different site types in Britain (King 2001; 2005), but has yet to be undertaken for dogs. By offering a wider range of data from secondary sources *and* from skeletons directly, the main strengths of each approach are combined to give a fuller picture of how dogs, and human-dog relationships, changed through time.

Secondary data from archaeological reports are essential 'building blocks' of any large-scale analysis. The Roman Rural Settlement Project provides most Roman rural data, which has been supplemented with smaller databases and manual data collection for Iron Age sites and other types of Roman site (see 3.1.2). The full dataset used in this section is contained in Appendix D.

4.1. Dog Numbers Through Time

4.1.1. Number of Identified Specimens

Most site phases, shown in Table. 4.1, clearly belonged to one period; the Late Iron Age/Roman transition is the one exception that had many site phases, largely due to the difficulty in distinguishing very late Iron Age from very early Roman contexts using ceramics (Smith and Fulford 2016: 404). Yet proportionally more Iron Age material was multi-phase, compared to the Roman data. Table 4.2 shows that nearly as many site phases were dated to the Early/Middle Iron Age and Middle/Late Iron Age as the Early and Middle Iron Age alone, while 61 site phases cannot be included in the analysis at all, as they span the entire Iron Age and/or Roman periods.

Phase	No. Sites	No. Site Phases	Phases w/Dog Remains	% w/Dog Remains	Total Dog NISP
EIA	16	16	14	88	1714
MIA	20	21	20	95	2052
LIA	90	92	75	82	2510
LIA/ER	82	83	69	83	2382
ER	155	192	156	81	6263
MR	114	126	108	86	5467
LR	175	193	172	89	17534

Table 4.1. Table of single phase sites and site phases.

Phase	No. Sites	No. Site Phases	Phases w/Dog Remains	% w/Dog Remains	Total Dog NISP
EIA/MIA	18	19	18	95	1092
MIA/LIA	15	15	14	93	1480
ER/MR	38	39	31	79	622
MR/LR	42	42	34	81	1044

Table. 4.2. Table of multi-phase sites and site phases.

The majority of site phases, around 80%, have at least one dog bone. The exact proportion varies, however, with a drop around the Late Iron Age and Early Roman period, before rising again slightly in the Middle and Late Roman. The mixed phase data in Table 4.2 follows this trend.

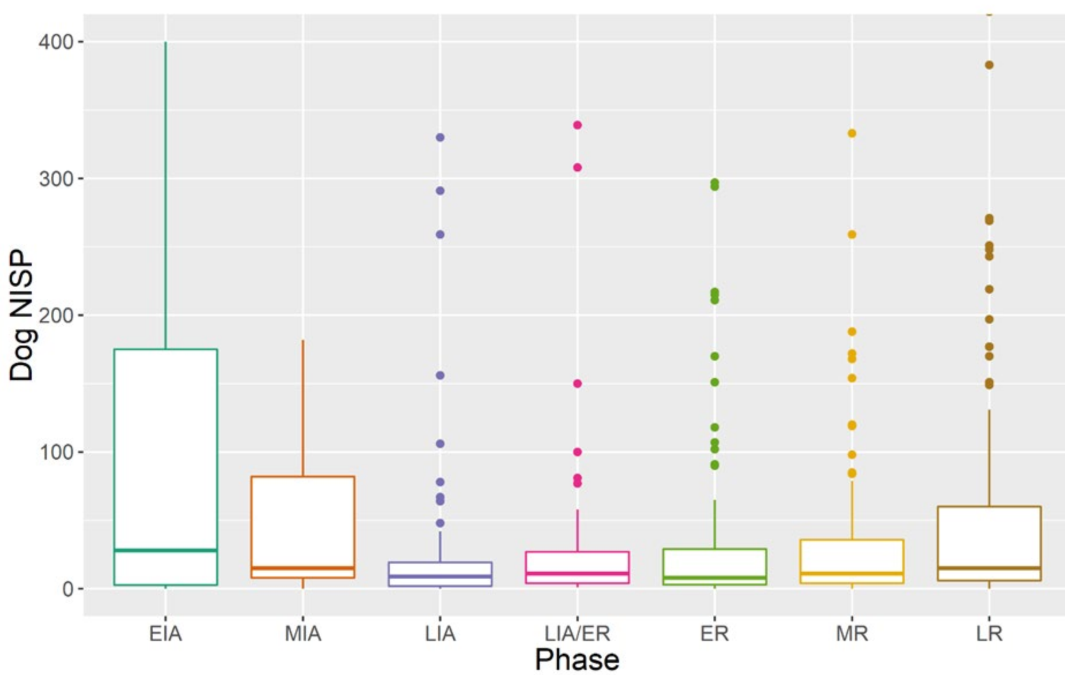

Fig. 4.1. Boxplot of dog NISP, sorted by major phase.

NISP is a useful marker for the presence of dogs from one phase to another. The Early and Middle Iron Age phases may be less reliable than the late Iron Age, as they consist of much smaller sample sizes; thus, trends shown in Fig. 4.1 may be due to unusual results within a small dataset. The Early Iron Age has a far higher upper quartile than any other phase, whereas the lower quartile of the middle Iron Age sample is elevated much higher than any other phase. From here the Late Iron Age numbers drop, across the board, and the other four phases show a modest, but consistent rise their range of dog numbers: this is evident in the upper quartile, median and interquartile range. Total NISP rises sharply in the Late Roman period, yet much of this rise comes from outliers not seen in the boxplot. Owslebury, Oakridge Well and Dalton Parlours all have very large phases ranging from 1350 - 4200 dog bones.

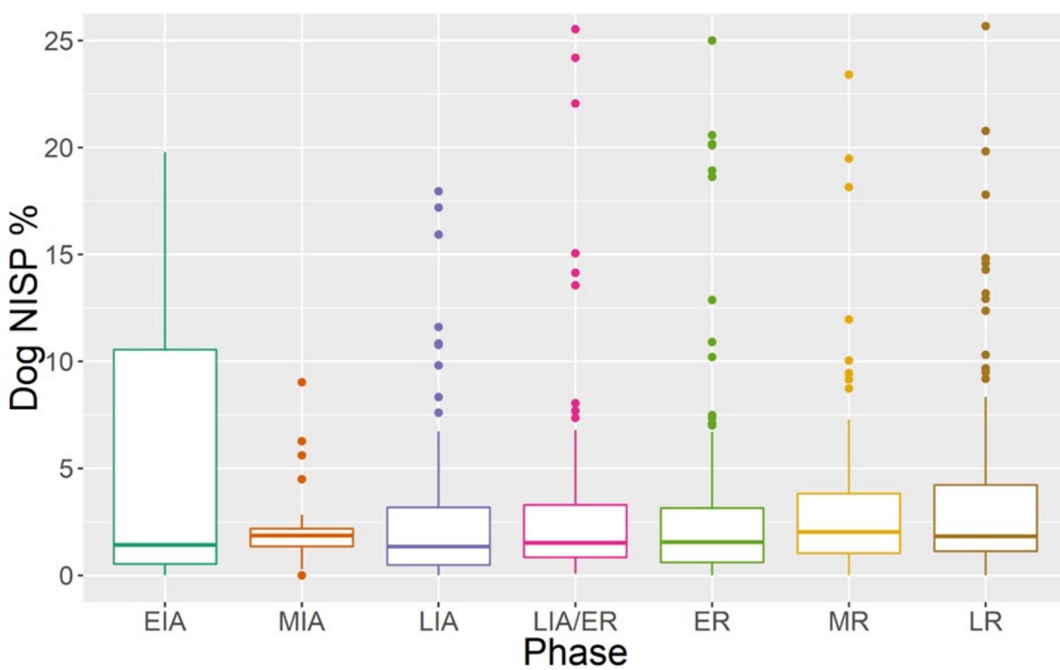

Fig. 4.2. Boxplot of dog %NISP numbers, sorted by major phase.

When %NISP is compared, Fig. 4.2 shows similar trends to the absolute numbers of dog bones. While the relative abundance of dogs still rises across the Roman period, the rise in median and upper quartile is smaller and peaks in the Middle Roman period, not the Late Roman. By contrast, the Middle Iron Age upper quartile decreases heavily and the

Late Iron Age median and upper quartile increase; the latter is only slightly lower than the Late Iron Age/Early Roman transition and Early Roman period. Essentially, fluctuations of dog numbers through time are less pronounced when their relative proportions are compared.

When tested using Kruskal-Wallis ANOVA (see 3.2.10), the overall p-value is extremely low at 0.0027, indicating huge difference between the phases. Post-hoc testing, however, shows that the only significant pairwise differences are between the Late Iron Age and Late Roman, and Early Roman and Late Roman phases (see Appendix B). That more variation exists within the Roman period than the Late Iron Age and Early Roman occupation is very interesting and will be discussed more later.

4.1.2. Associated Bone Groups

ABG numbers and proportions, as shown in Figs. 4.3 and 4.4, have similar patterns from the Late Iron Age onwards. Most site phases contain dog ABGs. However, most have only one or two, and many of these phases have no other ABGs present. The small datasets for the Early and Middle Iron Age make it difficult to state if the pattern is any different through these periods. Although these phases have relatively more sites containing three or more dog ABGs, which then make up lower proportions of total ABGs on a given site phase, each dataset is four to five times smaller than any other. Many of these site phases come from Danebury and other large hillforts that have high numbers of ABGs in total, as shown by the high number of total ABGs relative to other phases. Smaller hillforts and rural settlements from this period may or may not follow the same pattern, and a larger dataset is needed to clarify.

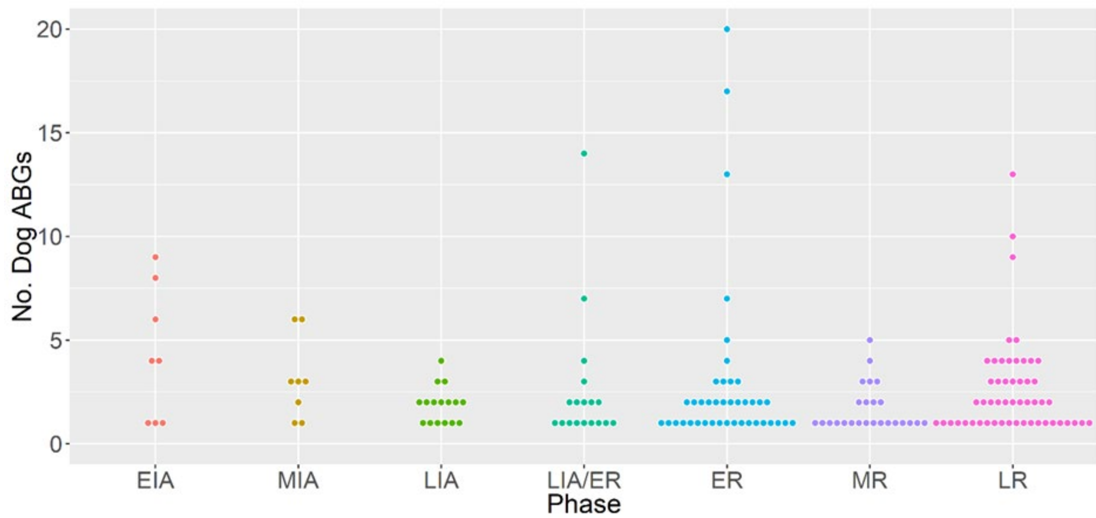

Fig. 4.3. Dotplot of dog ABG numbers per site phase, divided by overall phase (one dot = number of ABGs on one site phase).

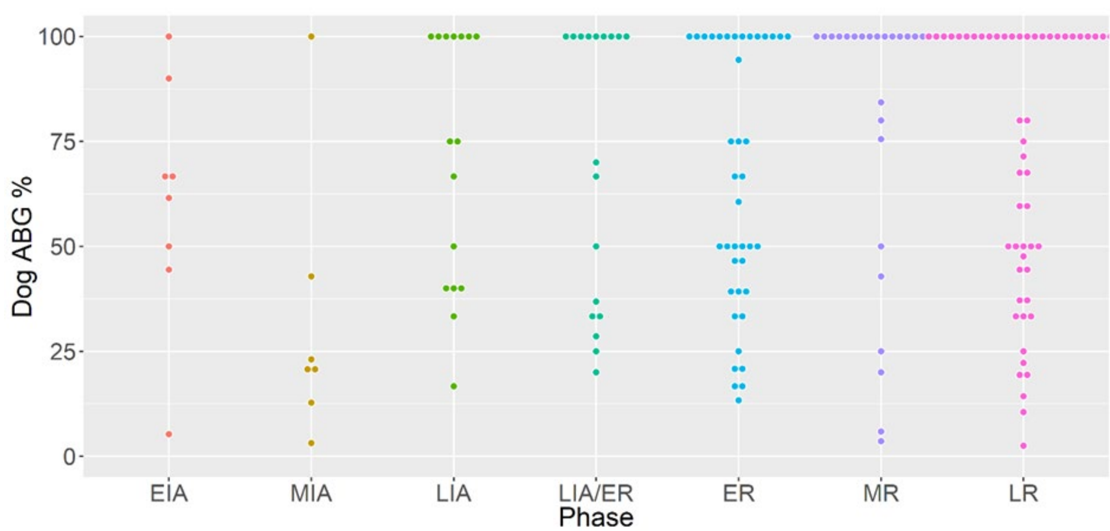

Fig. 4.4. Dotplot of dog ABG % (as proportion of all ABGs) per site phase, divided by overall phase (one dot = percentage of ABGs on one site phase).

The table shown in 4.3 has other notable trends: the ABG and dog ABG percentages follow a similar pattern to the NISP data. A drop in numbers occurs through the Iron Age which rise again through the Roman period, although never to the same level as the Early

Iron Age. On the other hand, the percentage of dog have a more random distribution with a large drop from the Early to Middle Iron Age, peaking again in the Middle Roman period. The numbers of ABGs drop after the Early and Middle Iron Age, but rise again through the Late Iron Age/Early Roman transition and Roman periods. The Late Roman period peaks at a huge 1066 ABGs (of which 410 are dog) for 193 site phases. However, no significant difference may be found; statistical testing gives a very high p-value of 0.44, and post-hoc testing gives no significant values between phases (see Appendix B).

Phase	No. Site Phases	% w/ABGs	Total ABGs	% w/Dog ABGs	Total Dog ABGs	Dog ABGs (as % Total)
EIA	16	69	79	50	34	43
MIA	21	38	132	38	25	19
LIA	92	33	91	17	30	33
LIA/ER	83	40	189	22	47	25
ER	192	32	458	22	155	34
MR	126	38	274	21	119	43
LR	193	43	1066	29	410	38

Table 4.3. Table of key ABG data, sorted by phase.

4.1.3. Section Summary

Comparing phases allows us to see broad change through time, before moving on to detailed investigation of settlement types. The analysis shows that dogs are present in all time periods. Slight differences in number of sites with dog bones, NISP and %NISP exist, which are statistically significant only between two periods: the Late Iron Age and Late Roman, and Early Roman and Late Roman. Essentially, the Late Roman period has more significant variation in dog numbers than between the Iron Age and Early Roman periods. The large drop from the Early and Middle Iron Age needs a larger dataset to confirm if the shift genuinely happened.

When ABGs are compared, no significant differences are present. There are, however, a few notable trends otherwise; the Late Roman period has a large ABG dataset encompassing more dogs than previous periods. Visually, the distribution is similar between phases. Most sites, if they have any ABGs, have only one dog ABG, and a small number have two or three. Few contain more than this. A larger dataset is needed, particularly given the challenges of testing a dataset containing many site phases that have no ABGs at all.

4.2. Settlements Through Time

Although change may have generally happened through time, Iron Age and Roman Britain were not homogeneous places. One of the most apparent differences are between settlement types: some were centralised places, some were large, some small, and some built for very specific purposes. The interactions with continental Europe and the annexation of Britain may have affected some site types more than others. The presence of dog remains, both disarticulated and articulated, may also vary.

I selected five main categories to compare: rural settlements, nucleated settlements, Roman urban sites, military settlements and key Iron Age sites. Two types of Iron Age site, hillforts and oppida, have been merged into one category (shortened to 'hillfort') due to their small datasets. Broadly speaking, the category represents important high-status settlements outside of farmsteads and small nucleated sites. The nucleated settlement category is drawn largely from Roman Rural Settlement Project data, which begins from the Late Iron Age. Of the enclosed settlements recorded in the Early and Middle Iron Age, none appeared to be comparable in size and importance to this category and were recorded as rural settlements instead: most nucleated settlements were close to Roman roads.

4.2.1. Settlement Type and Dog Numbers

On rural sites, the most populous category, dog %NISP drops across the Iron Age and rises across the Roman period (Appendix B). This is similar to the main patterns in 4.1. Nucleated settlements also rise in median and both quartiles from the Middle Roman period onwards. Military and urban sites, by contrast, do not increase consistently but peak and fall in other phases. The former drops in median, upper and lower quartile in the Middle Roman, and the latter in the Late Roman period.

The trends for hillforts and oppida may be seen in Appendix B, but contain very small sample sizes. Nucleated and military settlements suffer from a similar issue, with small datasets ranging from 4-29 site phases (Table 4.4). Given they have the largest sample sizes, is notable that neither urban nor rural sites are consistently higher in dog proportions than the other.

Phase	Hillfort	Military	Nucleated Settlement	Rural	Urban
EIA	5	NA	NA	11	NA
MIA	4	NA	NA	17	NA
LIA	8	NA	4	79	1
LIA/ER	3	1	6	73	NA
ER	1	27	16	85	63
MR	NA	11	17	65	33
LR	NA	12	29	99	53

Table 4.4. Number of site phases per major settlement type and phase.

Statistical testing shows very few significant differences between settlement types and phase. The only values that are significant are site types within the Middle Iron Age and Middle Roman, and phases within urban and military sites. Post-hoc testing is similarly unrevealing (Appendix B). Both tests suggest, however, that urban and nucleated sites differ from one another very little, whereas the other settlement types may be significantly different, if a larger dataset were tested.

4.2.2. Settlement Type and Associated Bone Groups

ABG proportions vary little between phases within a given settlement type; most site phases have only dog ABGs. This particularly affects the Early and Middle Iron Age rural data, and makes it impossible to state if ABG patterns were genuinely different from the Late Iron Age onwards. In rural and urban phases with larger datasets, however, there is only minor difference. More urban sites have only dog ABGs, whereas rural sites are slightly more likely to have a varying proportion of other animal ABGs (Appendix B).

There are two ways to test for ABG significance: individual settlement types by phase (e.g. rural settlements through time) and individual phases by settlement type (e.g. all settlement types in the Late Roman period). Neither yielded significant results. The settlement types within the Early Iron Age and Late Roman phases may, however, merit further investigation with a larger dataset (see Appendix B). Visually, when plotted as a dotplot, ABG proportions vary little between settlement types and phases.

Phase	Hillfort	Military	Nucleated Settlement	Rural	Urban
EIA	2	NA	NA	32	NA
MIA	3	NA	NA	22	NA
LIA	0	NA	2	28	0
LIA/ER	1	0	4	42	NA
ER	0	11	5	74	65
MR	NA	0	5	57	57
LR	NA	3	21	323	63

Table 4.5. Total number of dog ABGs per settlement type and phase.

Phase	Hillfort	Military	Nucleated Settlement	Rural	Urban
EIA	10	NA	NA	54	NA
MIA	21	NA	NA	19	NA
LIA	0	NA	25	39	0
LIA/ER	50	0	50	23	NA
ER	0	100	38	23	57
MR	NA	0	100	29	78
LR	NA	75	25	39	43

Table 4.6. Dog ABGs (as % total ABGs) per settlement type and phase.

When frequencies of dog ABGs are collated, there are key differences between phases and settlement types. The total number of dog ABGs in Table 4.5 is much higher on Late Roman sites across nucleated and rural settlements, but not urban sites. Yet, these ABGs form a higher proportion of assemblages on urban sites than nucleated or rural throughout the entire Roman period (Table 4.6). Rural ABGs follow a similar pattern to the %NISP data: proportions drop across the Iron Age and increase across the Roman period. Rural and nucleated dog proportions peak in the Middle Roman and drop in the Late.

Clear differences can be seen for hillfort and military sites. Hillforts have few dog ABGs, and these dogs form a small proportion of total ABGs at Early and Middle Iron Age sites, at only 10% and 21%. Conversely, military sites have dog ABGs exclusively or near-exclusively when present. This result brings up intriguing possibilities: other animals may have been selected over dogs for whole deposition on hillforts, and the reverse may have happened at forts.

4.2.3. Other Settlement Factors

The Roman Rural Settlement Project recorded a number of attributes about sites within its remit. Specific features of a settlement, such as paddocks and the presence of circular buildings, were noted. Most of these are irrelevant to the study of dogs, but several may be linked to reasons for keeping them:

- Settlement size
- Settlement form
- Presence of villa buildings (as defined by the RRSP; Allen and Smith 2016: 33-34).

When tested, no link could be found between site phases and settlement form, so settlement size and presence of villa buildings were investigated instead. Small and large settlements generally rise in dog %NISP through time, particularly their medians (Fig. 4.7). Beyond this, however, little difference is discernible. Only very small, inconsistent, fluctuations between settlement sites may be seen (Appendix B). No category has more dogs than others overall, and no phase has higher numbers of dogs across the board. Yet this result is statistically significant overall, with a very low p-value of 0.00092. Broken down by region, however, Middle Roman sites have the lowest p-value at 0.06 and post-hoc testing shows no significant value (see Appendix B). When size categories were tested instead, no significant values were found. While difference may have existed between settlement size and phase, it is not possible to pin down or ascertain where.

Differently sized sites vary little from one another. Similarly, the presence of villa buildings on a site has little effect on results. No overall higher or lower level of dogs may be seen when compared with sites that have no villa buildings (Appendix B). However, these results must be interpreted with caution. No villas were present in the Late Iron Age and few were present in the Early Roman period; the presence of villas in the RRSP data was noted per site, not per site phase.

Phase	Large	Medium	Small	Villas	No Villas
LIA	6	14	32	9	46
LIA/ER	5	16	42	15	55
ER	13	21	55	14	85
MR	15	18	36	13	67
LR	24	34	47	31	91

Table 4.7. Number of site phases by phase, settlement size and presence of villa buildings.

As with settlement size, statistical testing reveals no difference between villas and non-villa sites per phase. It does, however, show that phases differ significantly between non-villa sites, with an overall value of 0.026. Pairwise comparison produces no significant results, however (Appendix B). Villa sites have no difference whatsoever through time. Table 4.7. shows that the sample size is fairly small, so it is possible difference would be found in a larger sample.

4.2.4. Settlement Size, Villas and Associated Bone Groups

Phase	Large	Medium	Small	Villas	No Villas
LIA	4	6	10	4	16
LIA/ER	3	20	18	7	37
ER	14	12	49	3	74
MR	43	2	15	4	56
LR	23	83	223	13	319

Table 4.8. Total number of dog ABGs per phase, settlement size and presence of villa buildings.

Phase	Large	Medium	Small	Villas	No Villas
LIA	20	27	50	31	33
LIA/ER	75	43	16	58	22
ER	29	35	20	20	23
MR	78	22	16	24	31
LR	23	53	34	22	37

Table 4.9. Dog ABGs (as % of total ABGs) per phase, settlement size and presence of villa buildings.

The patterns of dog ABGs, and their proportions, did not vary by size or by presence of villa buildings. As with 4.1. and earlier in 4.2., most site phases had only one dog ABG and a smaller number had two or more: dog ABGs were frequently the only ABG on a site phase. When dog ABG numbers are instead aggregated, as in Table 4.8., a few general trends may be seen. Late Roman site phases had more dog ABGs in all categories aside from large sites.

However, this result may be caused by the larger animal bone assemblages on Late Roman settlements, such as Owslebury and Oakridge Well in Hampshire, rather than a proportional rise in dog ABGs. When the percentage of total ABGs are analysed in Table 4.9. instead, the Late Roman dominance is less. Indeed, for small sites, Late Iron Age settlements have the highest proportion of dogs. As with NISP%, large sites had the highest proportion of dog ABGs in the Middle Roman period. Overall, the phases with the highest ABG proportions vary by site size, and percentages of dogs differ heavily between phases.

As noted above, the RRSP did not record the presence of villa buildings by individual phase, but for the entire site, even if the villa was established partway through earlier settlement of the site (which accelerated from the second century AD onwards; Allen and Smith 2016: 34). Thus, the results for villa sites are slightly dubious: this not helped by the small size of the villa dataset (Table 4.9). Generally, in Roman phases, numbers of ABGs and proportions seem low, even in the Late Roman phase, where the sample size is bigger. Not much case can be made for more dogs being kept on villa sites.

4.2.5. Section Summary

	Key Results
Overall NISP & %NISP	Fall in dog NISP through the Iron Age, rising again in Middle and Late Roman periods. Less pronounced rise and fall for %NISP data, but overall pattern identical to NISP. However, the only significant differences are between the Late Iron Age and Late Roman, and Early Roman and Late Roman periods, suggesting no dramatic shift in dog numbers post-Conquest.
Overall ABG and %ABG	ABG patterns are similar across time. Most sites have one dog ABG, and with decreasing numbers of sites containing two or more. Patterns similar for %ABG: most sites, regardless of phase, contain only dog ABGs.
Settlement Type	Some consistent trends through time. Most settlement types follow similar patterns as overall NISP/%NISP, except for urban and military sites, which fall in the Late Roman period. Very few significant differences were found between settlement types or phases. Greater likelihood of difference between settlement types for ABG deposition. Urban sites have a higher proportion of dog ABG than rural settlements, while military sites have few ABGs overall but nearly all of these are dogs. Conversely, hillforts have a much smaller proportion of dog ABGs than other sites. However, larger sample sizes are needed to ascertain.
Settlement Size	Overall, NISP and ABG numbers vary little between size categories. Although very small variation is present within size categories, it is inconsistent. Each size category has its own pattern of where %NISP peaks and falls through time, and few results are significant. Only the Central Belt has significant difference between large and medium/small sites. Thus, it is possible that larger sites had slightly more dog bones (and dogs) than smaller sites, but it is uncertain if this applies to all regions.
Villa Buildings	No significant differences between sites with villa buildings and those without.

Table 4.10. Summary table of key phase results.

All settlement types and sizes had dogs. They show less numerical variation than what may be expected of diverse settlements, with %NISP differences mostly 3% or less. This applies to different types, and within the same type over time. Numbers of dogs fall slightly across the Iron Age and rise again throughout the Roman period, although this does not apply universally to all settlement types. Each has a slightly different pattern, but the numerical differences are mostly statistically insignificant, aside from a few results in the Middle Iron Age and Middle Roman periods.

The detectable differences through time seem to be mainly *within* the Iron Age and Roman periods, not between them. The first period is less reliable, given the smaller dataset, and needs more data to ascertain that it varies from the latter. Yet the Late Iron Age data, with a larger sample size, barely differs from the transitional and Early Roman samples. This trend is of particular importance, particularly when considering the main chapter question later on. ABG proportions hint at some differences between settlement types: urban sites have a higher proportion of dog ABGs than rural settlements. Hillforts and military sites may have unique trends: the former for high numbers of ABGs that are not dog, and the latter for having few ABGs that are near-exclusively dog. Their small sample sizes, relative to other types, make any conclusive statements impossible.

Variance by settlement size and villa buildings is even less certain. Ultimately, villas are unlikely to be a place where dogs were kept more than on other settlements, despite (or perhaps because of) their higher status. Nor did settlement size greatly affect the numbers of dogs kept.

Looking at bone reports within solely Britain shows how dog numbers may have varied through time. Ideas from and exchange with mainland Europe, particularly just before and after the Roman Conquest, may also be responsible. To understand the wider context in which changes took place, a cautious look at key Roman texts concerning Britain and trade is worthwhile. But before I do so, a focused look at dog skeletons can also show signs of change through time, particularly trade, between Britain and mainland Europe.

4.3. Dog Associated Bone Groups Through Time

The Southeast and East of England have been selected for a more focused study, as the vast majority of ABGs originate from this area (Appendix E). Of these 85 ABGs, 25 were dated to the Iron Age and 58 to the Roman period. This dataset presents some challenges, as it is relatively small, but this is compensated by the depth of data for each ABG: many attributes of these dogs will be compared against one another, not just one. These include: completeness, size and shape, age and include minor attributes such as deposition and gnawing. The number of individuals reliably determined by sex using the baculum (see 3.2.6.), at only 10 ABGs, is too small to analyse comparatively. Furthermore, as a key theme of this research, I will analyse pathology separately in Chapter 6.

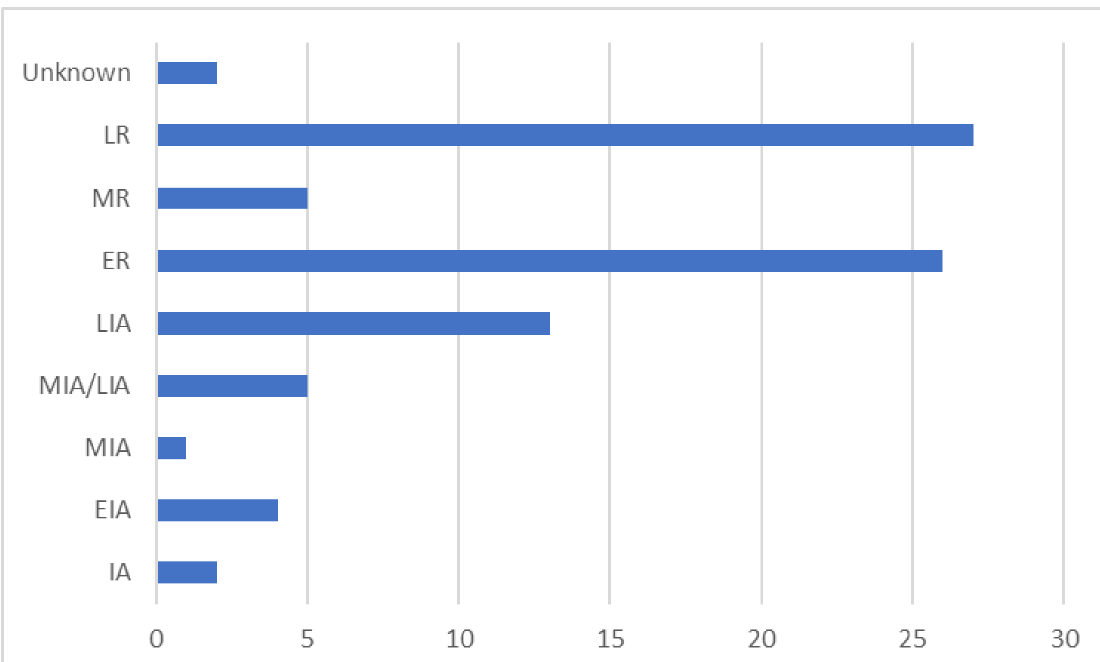

Fig. 4.5. Number of dog ABGs per phase.

It will not be possible to analyse all phases within these two broad categories, as 4.1. did: the sample sizes are far too small. Fig 4.5 outlines the specific phases each dog dates to. Two can only be attributed to the Iron Age or Roman period more generally: otherwise, most dogs date to either the Late Iron Age, Early Roman or Late Roman period. As Fig. 4.6 and 4.7 show, the Iron Age ABGs come from a wider range of sites: the Roman material comes from almost exclusively from Owslebury, Greyhound Yard, Oakridge Well and Baldock.

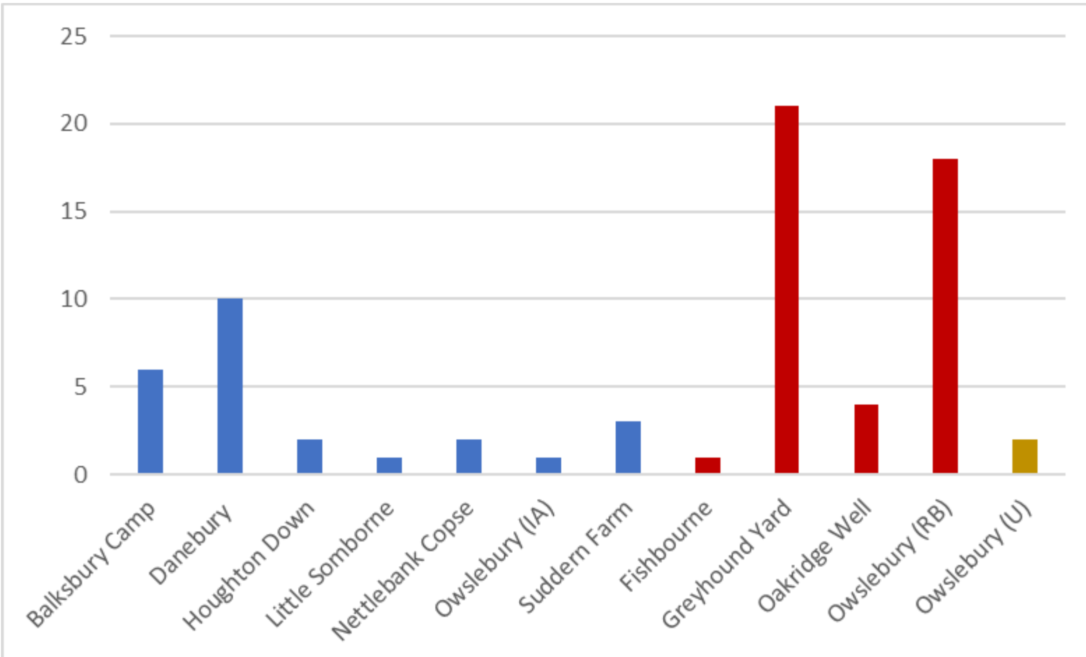

Fig. 4.6. Number of dog ABGs from Southeast Britain by site.

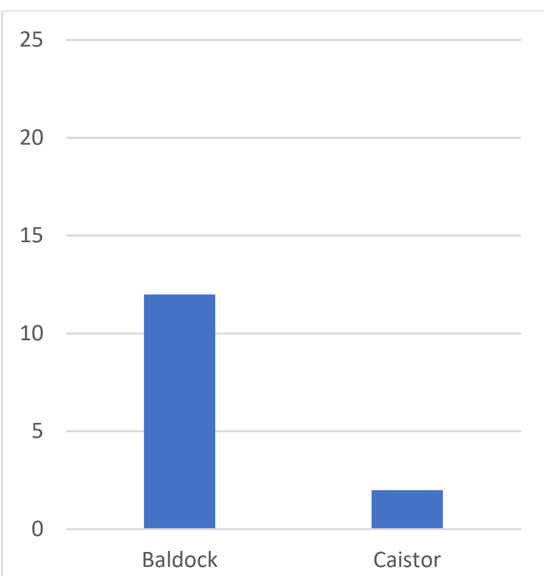

Fig. 4.7. Number of dog ABGs from Eastern Britain by site.

4.3.1. Canine Jigsaws

The canine ‘jigsaw’ is made up of the whole skeleton, general anatomical areas, and individual elements and teeth. ABG recovery was highly variable. A few dogs were nearly complete, whereas some had less than five elements and/or whole anatomical areas missing. This section will discuss how well the ABGs survived, using the methods outlined in 3.2.5 and 3.2.6: total bone counts, completeness by body part and completeness by survivability. The main unit of quantification is the average percentage of bones that survive per anatomical area or category. Statistical testing is used to check whether unusual results are due to chance, as per the methods outlined in 3.2.10.

Total Bone Counts

Total bone counts are not fully representative of the skeleton. Two ABGs may have similar bone counts, but completely different patterns of survival. One may have only ribs and vertebrae, whereas another may have larger elements such as the skull, mandible and pelvis. However, the method is a useful starting point. There is slight variation of bone numbers in a complete canine skeleton: the tail may vary in length from 6 to 23 bones, with an average of 20 (Miller *et al.* 1964: 58). The average total, of 319 bones (1964: 1), will be used as a marker, from which the ribs and carpals/tarsals I and II will be subtracted, as discussed in section 3.2.5.

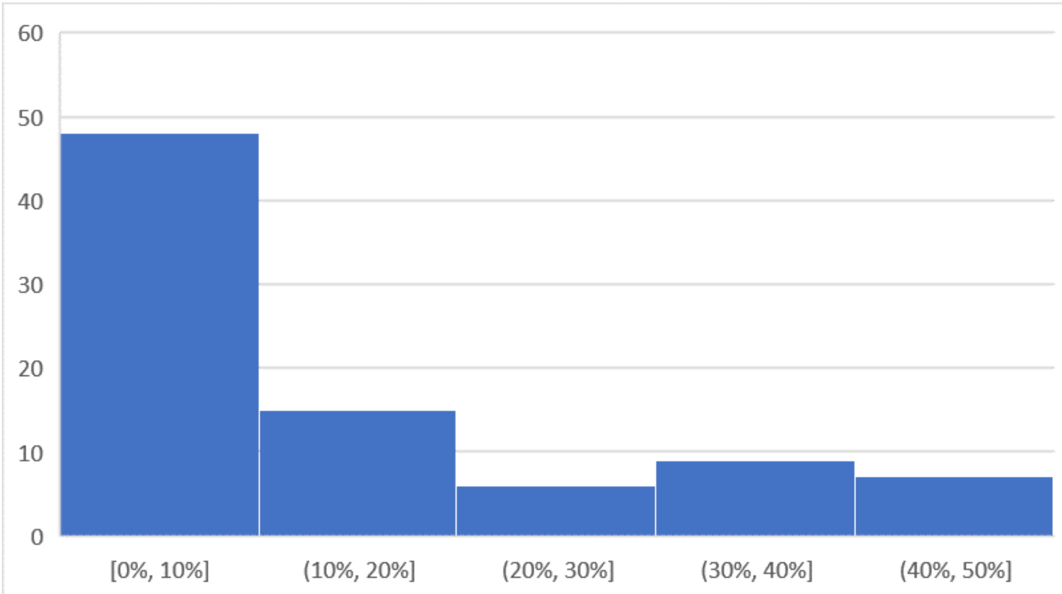

Fig. 4.8. Number of ABGs by percentage of bones recorded.

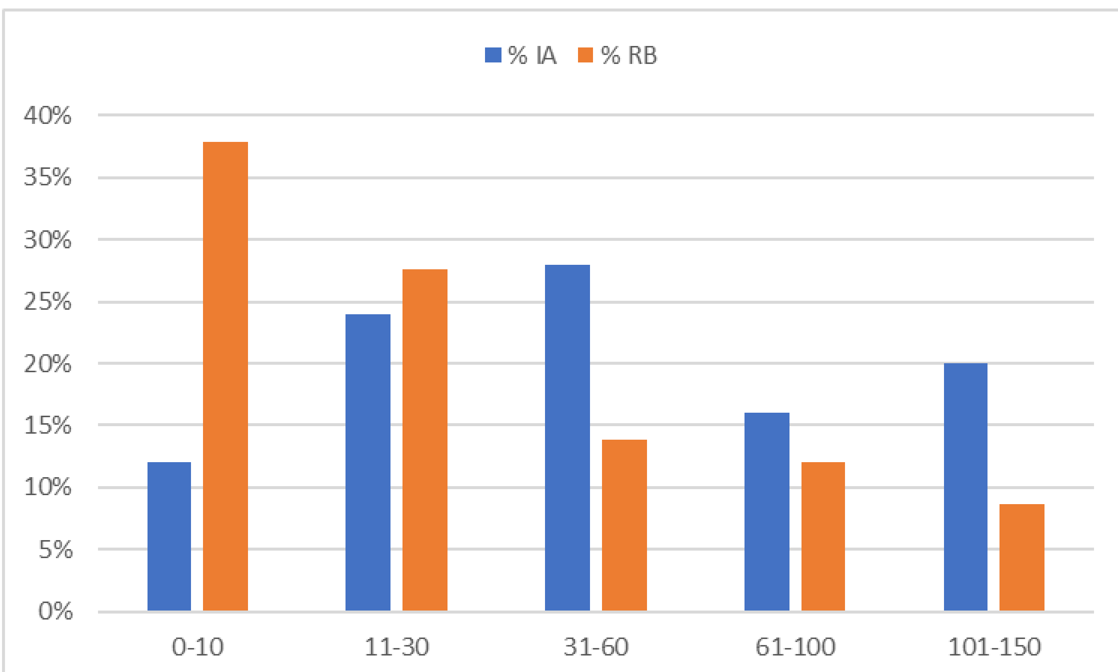

Fig. 4.9. Numbers of bones that survive in dog ABGs, by percentage of total ABGs per phase.

Most dogs experienced considerable loss of bones, even fairly well-preserved specimens. Many were represented by ten or fewer bones, and even the best-preserved dog skeletons were less than 50% complete. Forty-nine ABGs have less than 10% bone survival, and only 16 have survival rates of over 30% (see Fig. 4.8). Interestingly, over three times as many Roman dogs have fewer than 10 elements than Iron Age specimens (see Fig. 4.9); twice as many Iron Age dogs have over 100 surviving bones. Testing indicates this difference is significant between phases ($\chi 2 = 6.6394$, df = 1, p = 0.001), indicating a high likelihood that Iron Age dogs surviving better than their Roman counterparts overall is not due to chance.

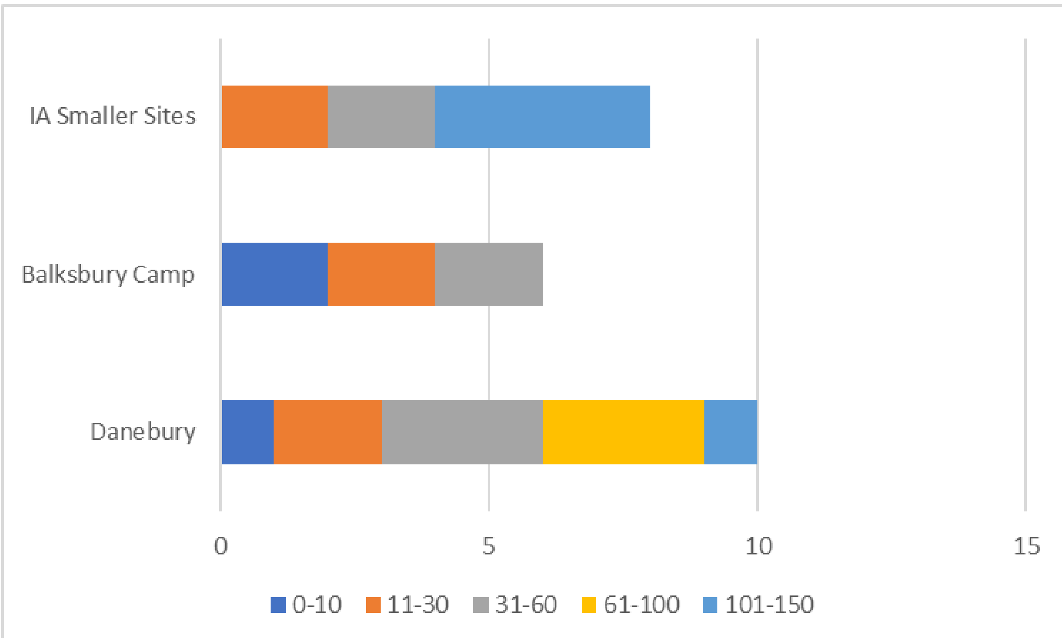

Fig. 4.10. Numbers of bones that survive for Iron Age ABGs, by number of ABGs per site.

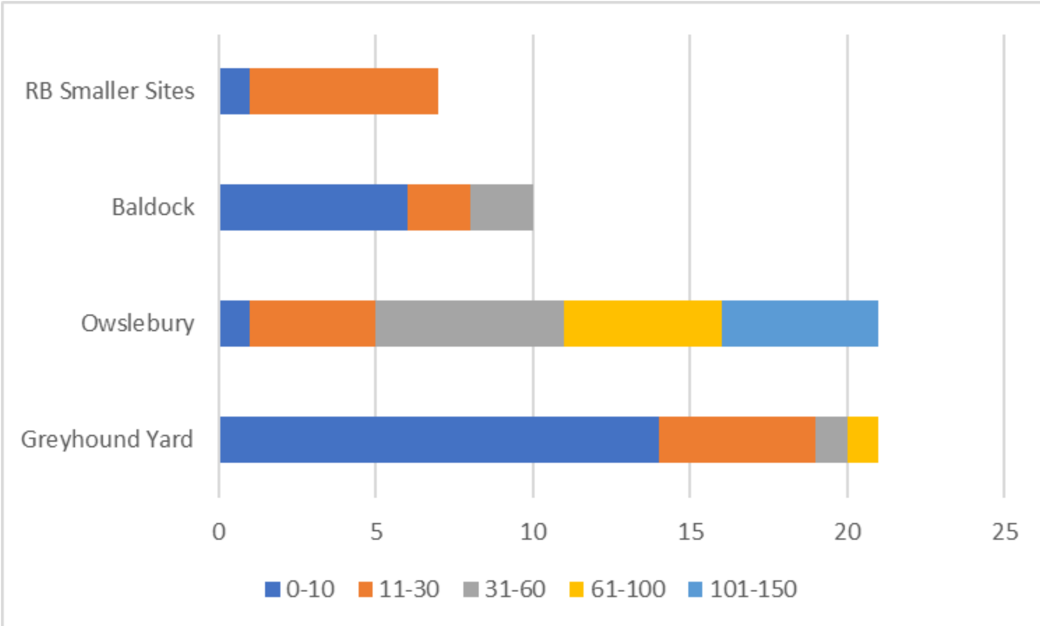

Fig. 4.11. Numbers of bones that survive for Roman ABGs, by number of ABGs per site.

Exploring inter-site variation (see Figs. 4.10 and 4.11) shows that, for the Roman sites, ABGs with few elements are the norm; Owslebury is the exception, with five ABGs that have 100 or more elements. By contrast, the Iron Age sites have a consistently higher survival of ABGs, albeit with some variation: Balksbury Camp ABGs are less complete than Danebury's. Now that numbers have been established, we need to find out *which* elements are most likely to survive.

Completeness by Body Part

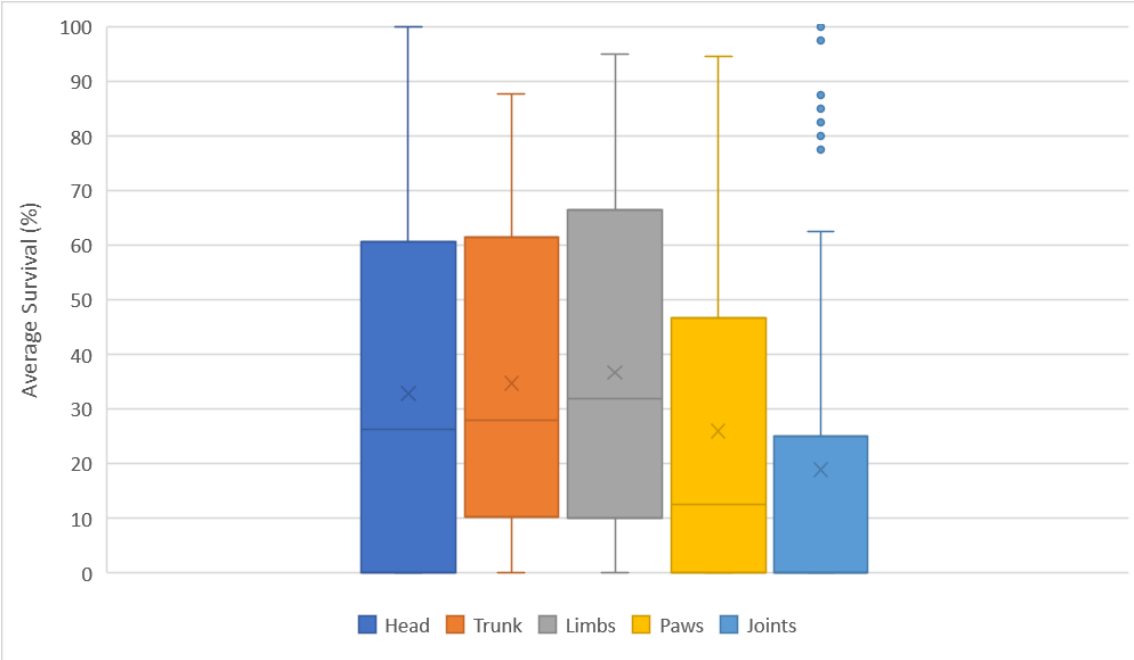

Fig. 4.12. Frequencies of ABG survival by body part (see 3.2.2.), sorted by percentage range.

The results suggest that the small joint bones are least likely to survive, followed by the paw, head and trunk bones (Fig 4.12). The long bones are most likely to be recovered. If we examine Figs. 4.13 and 4.14, it is clear that in IA specimens, the head, trunk and limbs survive better than Roman ABGs. From this, it is important to note that pathology in Roman ABGs may be relatively under-represented in these areas. However, a high proportion of the Iron Age ABGs come from Danebury (10) and Balksbury Camp (6), and the Roman results from Owslebury and Greyhound Yard (20 and 21 respectively). How bones survive on these sites in general has already been established, but not particular body parts.

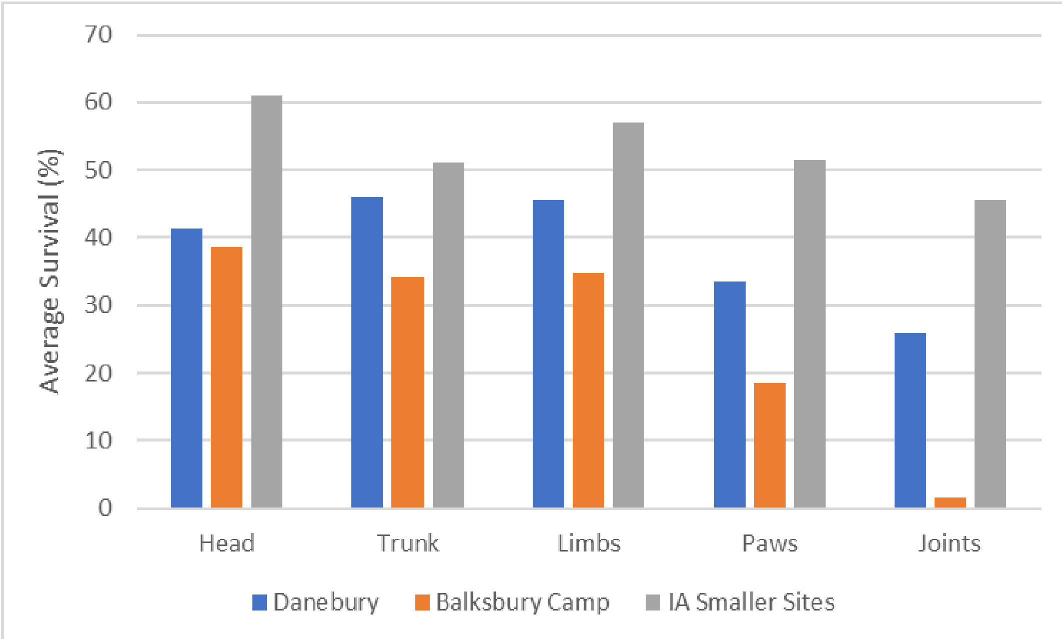

Fig. 4.13 Average survival of body parts (per ABG) on Iron Age sites.

It is noteworthy that while Iron Age survival rates vary by site, the overall patterns are consistent (see Fig. 4.13). The best survival rates come from the sites with three or less ABGs (defined as 'smaller' because of fewer ABG samples, not overall site size), followed by Danebury and Balksbury Camp. Paws and joints survive less well than the head, trunk and limbs on all sites. They do, however, survive better relative to other body parts on the other IA sites. There is a little variation between head, trunk and limb survival, but no site displays any major difference.

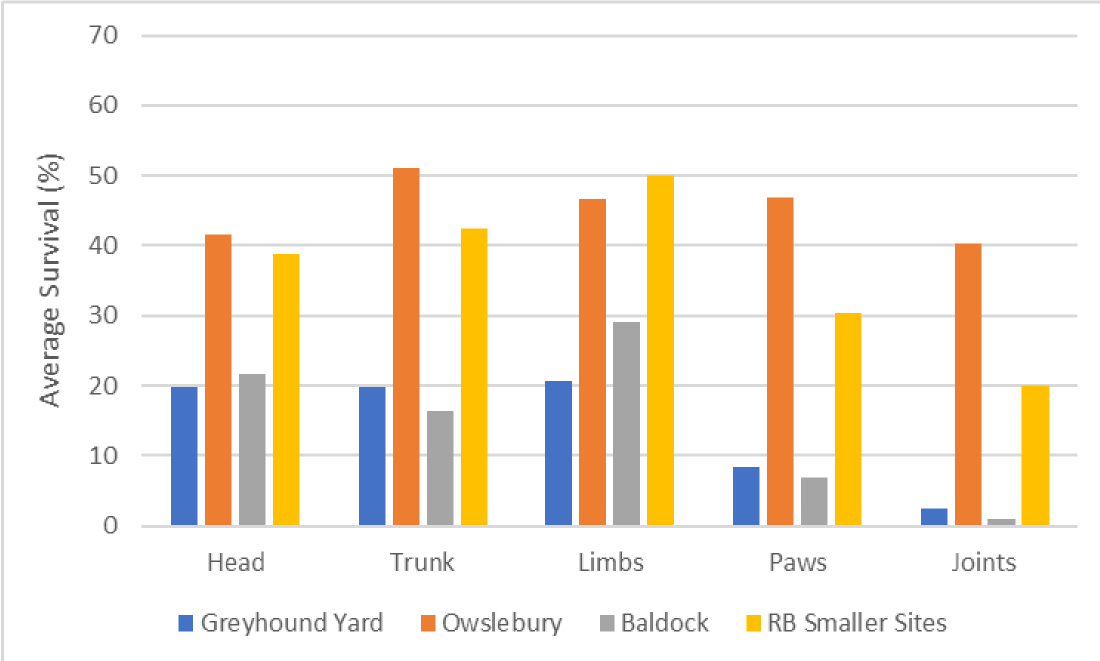

Fig. 4.14 Average survival of body parts (per ABG) on Roman sites.

The pattern on the Roman sites is similar to the Iron Age (see Fig. 4.14), although the inter-site difference is much greater and the overall survival rates lower; Owslebury and the smaller sites, which survive the best, still have rates lower than or just equal with the Iron Age sites. In general, head, trunk and limb bone survive best, although there is some variation: representation at Greyhound Yard us very even, while Baldock has nearly twice as many limb bones than trunk. Overall, paw and joint survival is lower, but less dramatically so at Owslebury where the paw rate is equal to the limbs.

There is a significant difference in survival between sites when tested using chi square ($\chi 2 = 758.76$, df = 24, p = 2.2e-16). Standardised residuals are useful for clarifying this difference (see Appendix B), and indicate that many of the Roman sites have paw and joint survival significantly below expected, but proportionately higher limb survival (albeit lower than the Iron Age in absolute numbers: see 6.1.3). Variation within the phases is also significant, with Balksbury Camp displaying survival rates more typical of a Roman site.

The lower average survival of small paw and joint bones on Roman sites may be caused by a number of factors. The first is poor recovery by excavators, which given that sites vary from one another, may be partly responsible. Yet material may also have been redeposited or damaged in the long years it was buried. This would have affected all bones to some degree, but the smallest bones may have been at especial risk of damage beyond identification or disassociation from the rest of the ABG. Another, which will be investigated in more detail through preservation and gnawing analysis later in the chapter, is disturbance *before* final burial. The body may have been disturbed by predators or subject to harsh weather conditions, both of which may lead to the loss of the small bones.

Completeness by Survivability

Bone survivability affects ABG survival. Very small, dense bones (such as the tarsals) are less likely to survive due to both recovery and taphonomy issues; meanwhile, larger more dense bones are more so (see 3.2.2). Investigating this can help refine differences observed between different sites: not just which bones survive, but why.

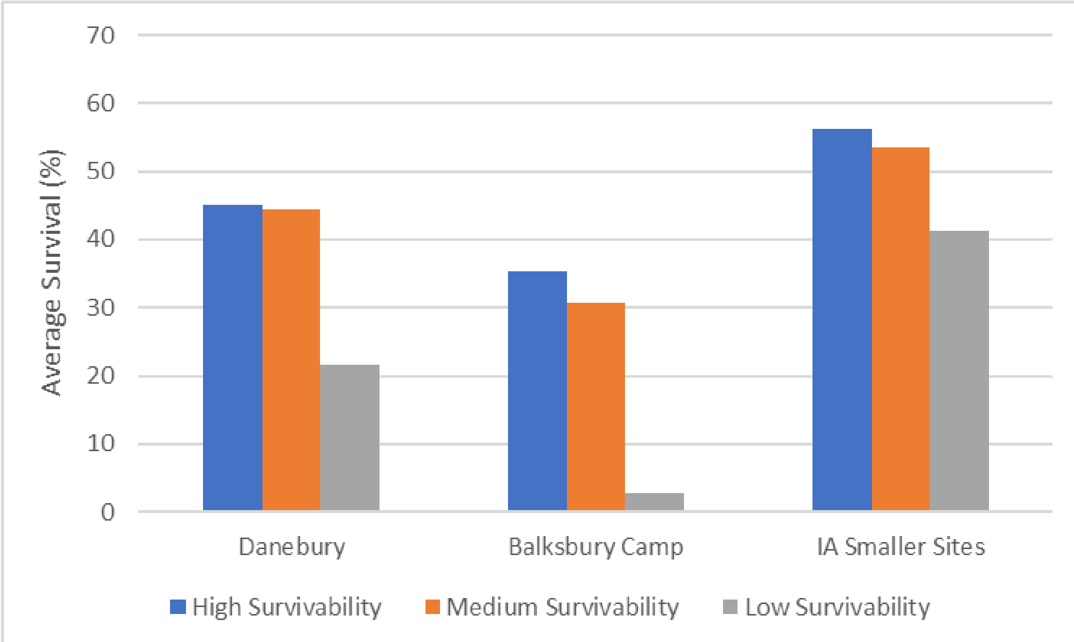

Fig. 4.15. Average survival of ABGs, by survivability category on Iron Age sites (see 3.2.7).

For the Iron Age, it is noteworthy that bones of high and medium survivability are present at nearly the same frequency (see Fig. 4.15). This is true for all Iron Age sites; the greatest difference at Balksbury Camp is only 4%. The difference between medium and low survivability is more variable: it is huge on Balksbury Camp, but relatively minor for the smaller sites. This pattern correlates with the overall survival rate, demonstrating that the denser bones are more likely to survive.

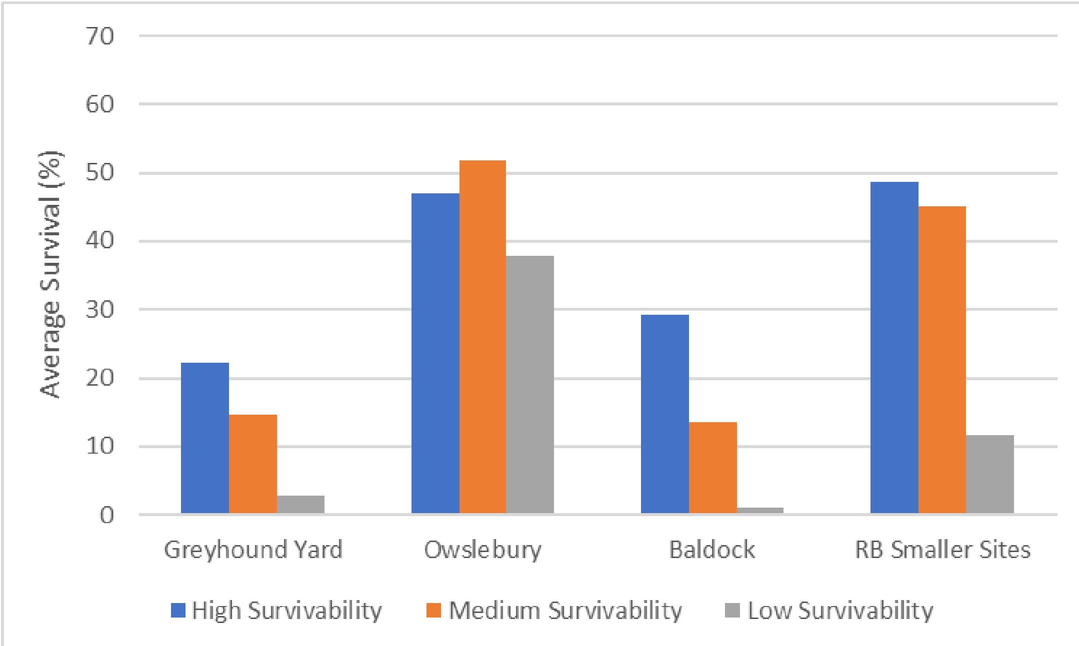

Fig. 4.16. Average survival of ABGs, by survivability category on Roman sites.

Differences between the high and medium categories are slightly more variable on Roman sites. In general, however, the same gradient is observed: the least dense bones are recovered less often than the bones with the highest survival potential (Fig. 4.16). The one exception is Owslebury, where bones of medium survivability exceed the highest and those in the lowest category are close to 40%.

Section Summary

Overall, most ABGs lose a considerable number of bones between death and recovery; all lose at least 50% and nearly half lose over 90%. Of the bones that survive, the limbs and trunk survive the best and bones with the highest density are more likely to be recovered, although it remains to be seen which elements survive within these groups. In terms of overall bone survival, there are clear differences between Iron Age and Roman ABGs. Iron Age ABGs have a much higher rate of bone survival across all sites, whereas Roman ABGs have a lower rate and more variation across sites. Urban-rural differences in completeness are difficult to judge, as most of the urban results come from Greyhound

Yard, and most of the rural from Owslebury. Overall, ABGs from urban sites appear to survive less well than those from rural sites.

These patterns may affect the incidence and interpretation of pathology in several ways. Paw and joint pathology will be under-represented across the board, as will head, trunk and limb pathology to a lesser degree. Bones of low survivability, regardless of the body part they come from, will be heavily under-represented. Pathology may be under-represented in the Roman ABGs relative to their Iron Age counterparts, and urban ABG pathology may be somewhat under-represented. These factors will be taken into account later in the chapter.

However, it remains to be seen how the key elements survive across phases and site types. For instance, how well does the skull survive relative to the mandibles? The following sections will now analyse more detailed parts of the body.

4.3.2. Anatomy in Focus

This section focuses on the major skeletal elements that were recorded by anatomical zone, which largely belong to the head, trunk and long bones; the paws and joints have already been analysed for completeness. It is very important to establish how well each element survives *before* the pathology is analysed. If, for instance, the scapula survives more poorly than the other elements, then this needs to be considered. A low level of pathology may reflect its generally poor survival, rather than a low incidence.

The Cranium and Mandibles

As shown in Fig. 4.12, the head survived well amongst the ABGs. However, a closer look reveals a distinction between the skull and the mandibles. The latter had a very good chance of surviving mostly intact but the cranium did not, and was mainly recovered as small fragments (e.g. Stages 2-3; Fig. 4.17). Ultimately, this will have an adverse effect on efforts to determine the size and shape of the head later in the chapter.

As Figs. 4.13 and 4.14 demonstrated, the heads of Iron Age ABGs had better rates of survival than their Roman counterparts. The skull follows this pattern, with an interesting caveat: Iron Age dogs had a significantly higher frequency ($p = 0.009$ with Fisher's Exact Test) in the more complete stages 3-5 (Fig. 4.18). However, the rates of survival for Stages 1-2 are almost identical. Both periods have an equal proportion of heavily fragmented crania.

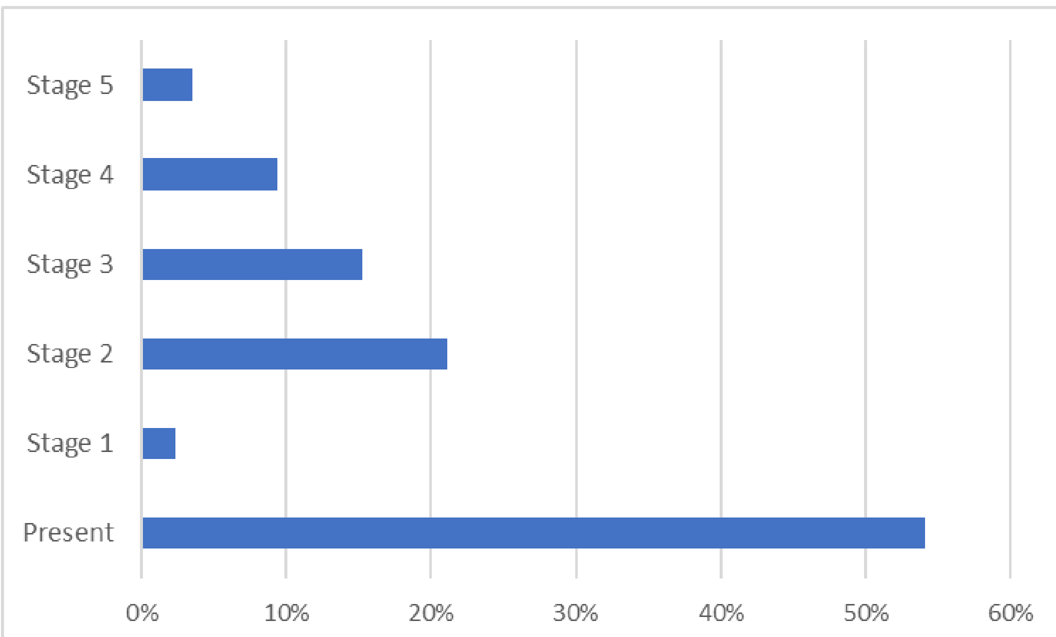

Fig 4.17. Skull stages and overall presence for all ABGs. (Full definitions for each stage outlined in 3.2.1., from heavily fragmented to complete.)

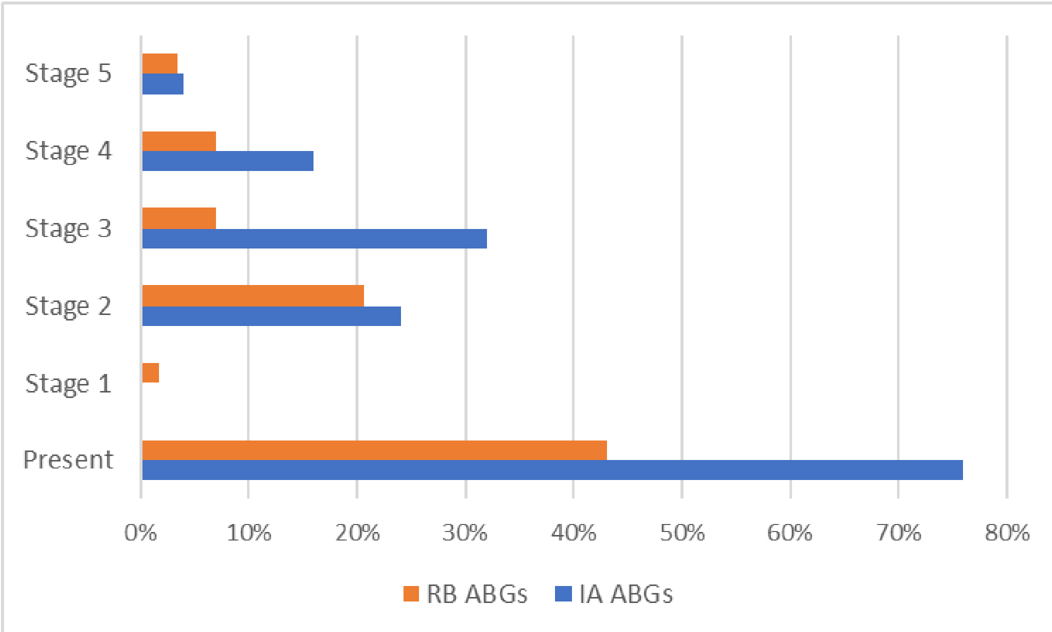

Fig. 4.18. Skull stages and overall presence for ABGs, by phase.

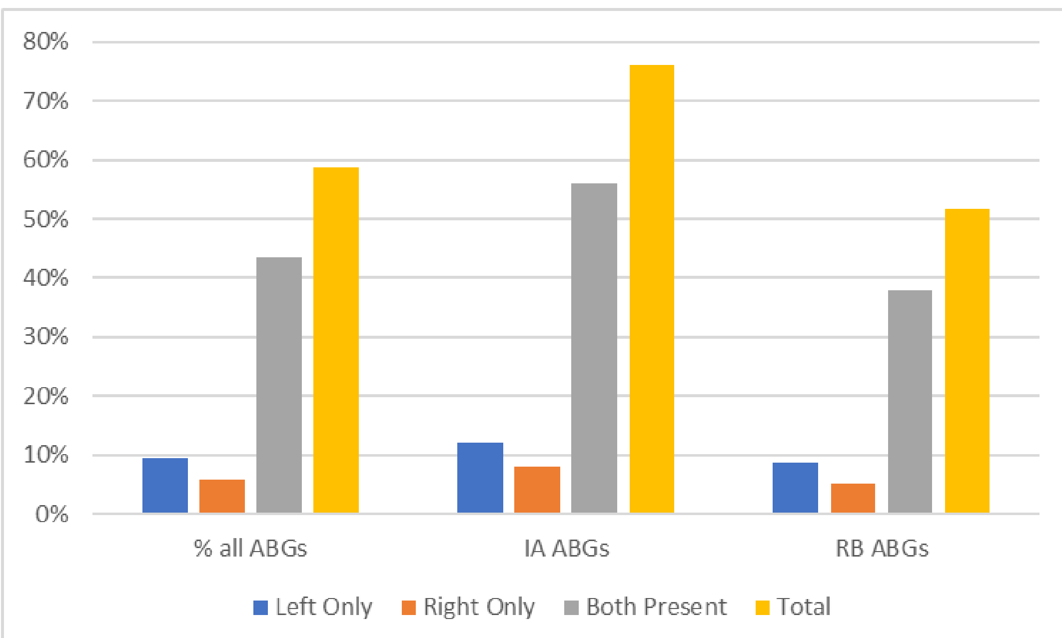

Fig. 4.19. Overall ABG presence for mandible, by phase.

Fig. 4.20. Mandible zone survival for ABGs.

There is a less dramatic difference between Iron Age and Roman ABG mandible survival (Fig 4.19). The frequency for Iron Age mandibles is higher by 22% overall, but the proportion of ABGs that have both mandibles survive, not just one, is similar between the two. With only a p-value of 0.19, however, this variation is not significant. Both phases have the same zone pattern: zone 6 (the main toothrow) survives best. Zone 8 has the lowest rate of survival, which may be due to the fragility of this area. Interestingly, the front of the mandible survives slightly better in Roman ABGs (Fig. 4.20).

A Toothy Puzzle

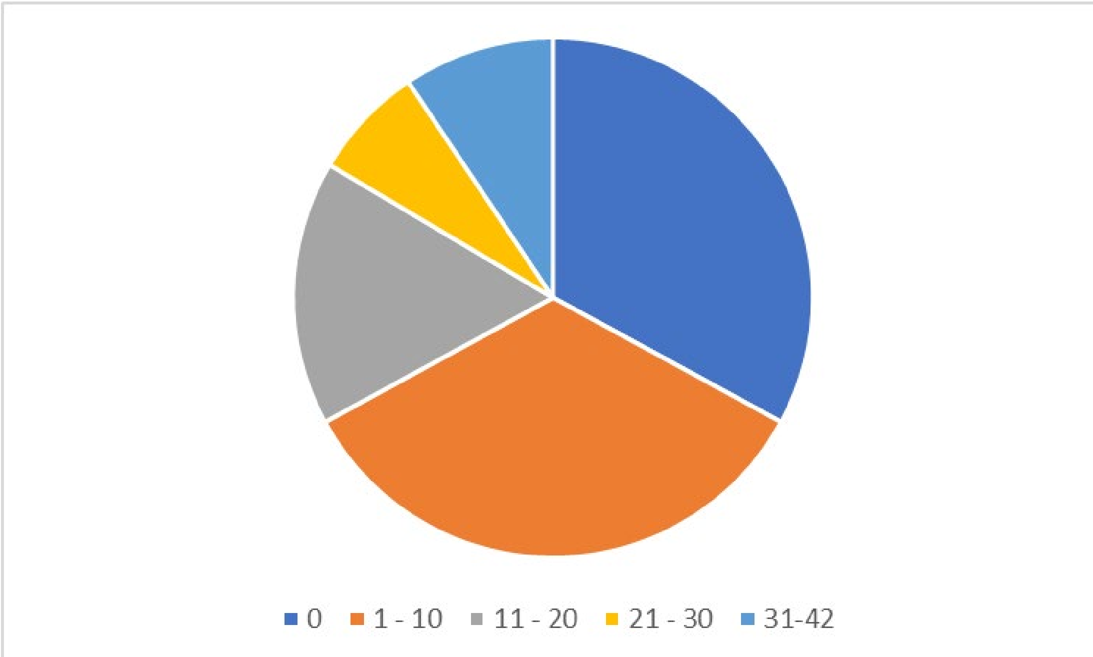

Fig. 4.21. Numbers of teeth that survived in ABGs (either loose or still in the mandible/maxilla).

The survival of teeth was as variable as the bones. Fig. 4.21 outlines the overall range of tooth survival, showing that over half of ABGs had 10 or less teeth survive. 33% of ABGs had no teeth at all, and only 9% had more than 75% of their teeth. The remainder ranged from as little as a single tooth to the entire dentition (42 teeth).

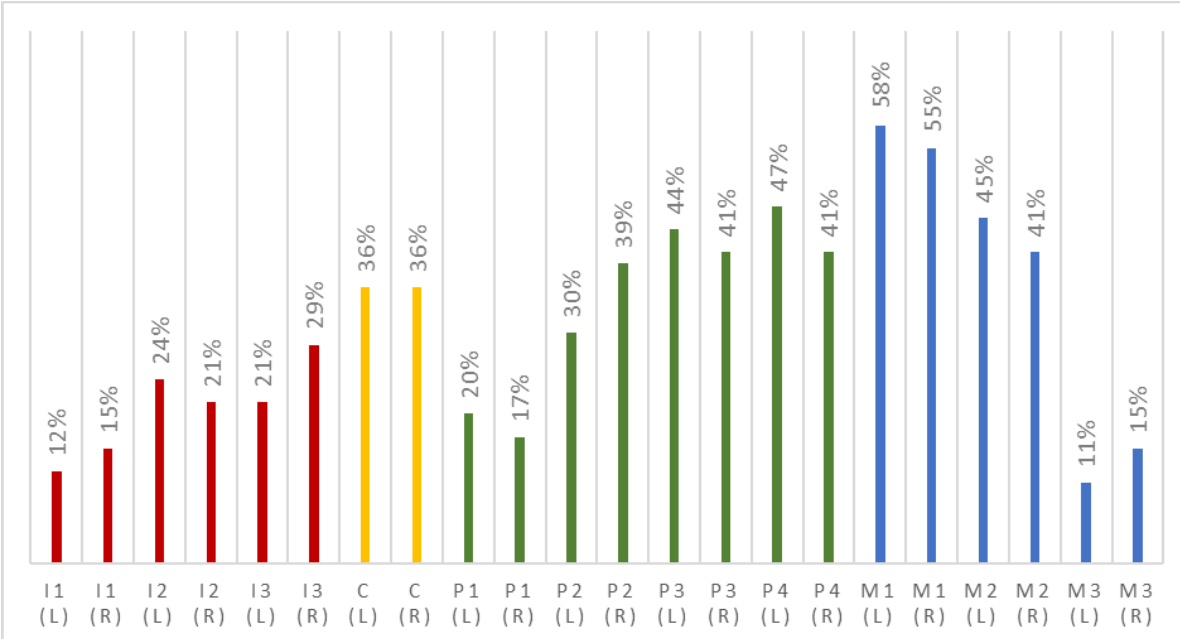

Fig. 4.22. Percentage survival for each adult mandibular tooth.

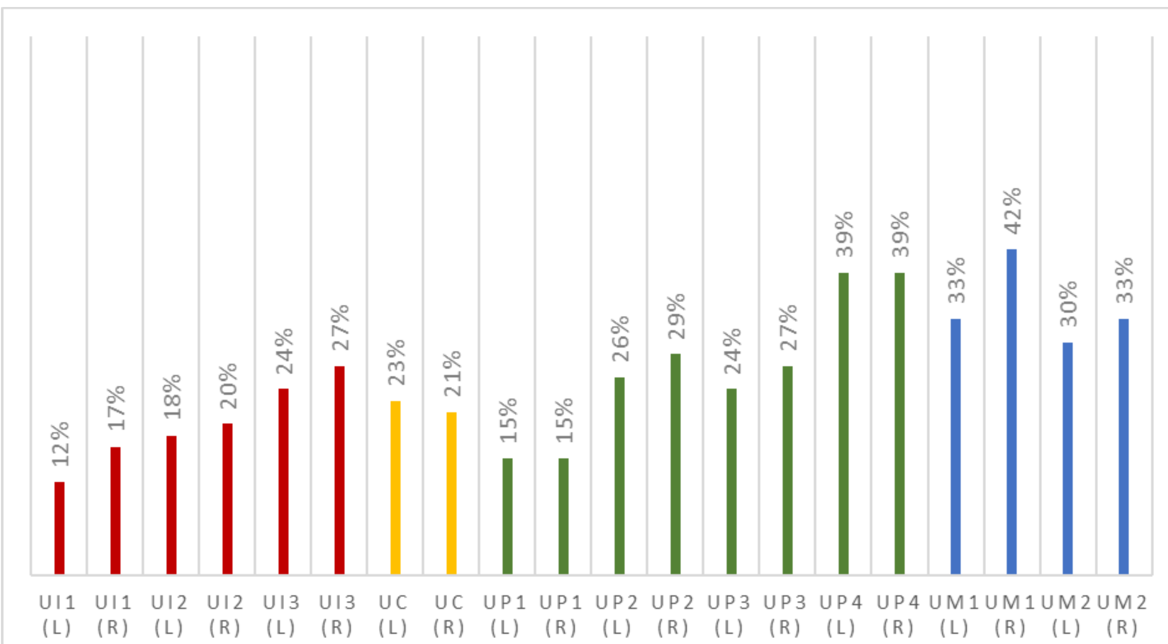

Fig. 4.23. Percentage survival for each adult maxillary tooth.

However, this does not indicate *which* teeth necessarily survived, or how they survived. Teeth may survive either in-situ in the mandible, or as loose teeth. Overall, the third and fourth premolars and molars (except for the third) were more likely to survive (Figs 4.22

and 4.23). Mandibular teeth survived better than maxillary teeth, which may reflect the greater robustness of the mandible.

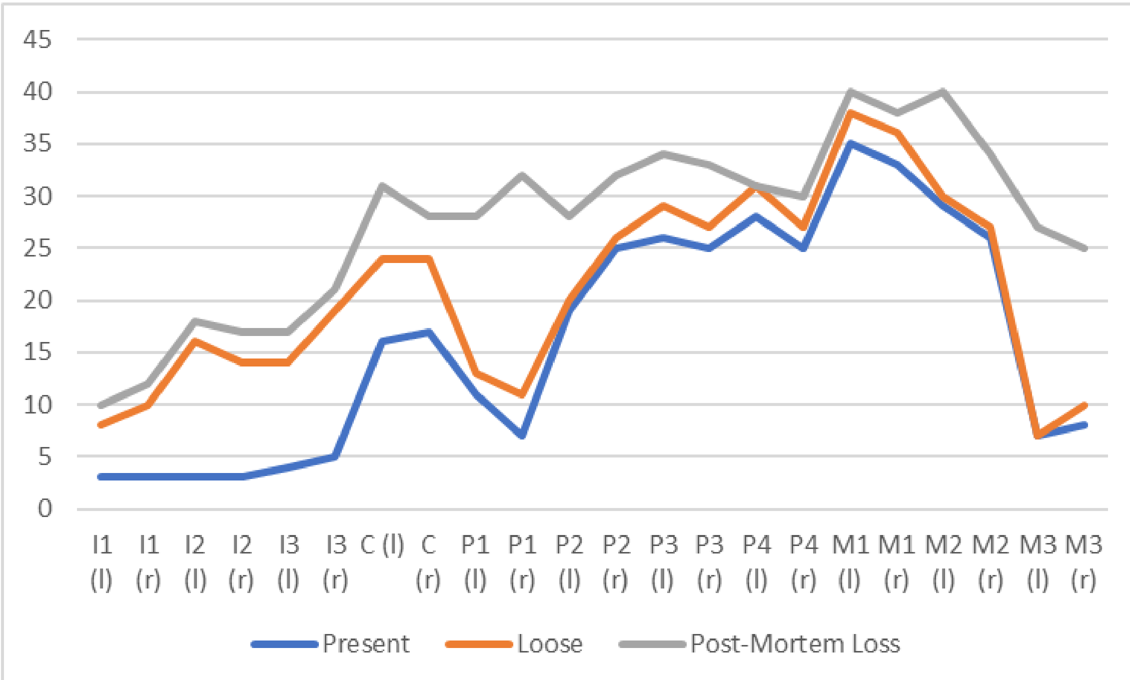

Fig. 4.24. Percentage survival for loose and in-situ adult mandibular teeth, against teeth lost post-mortem.

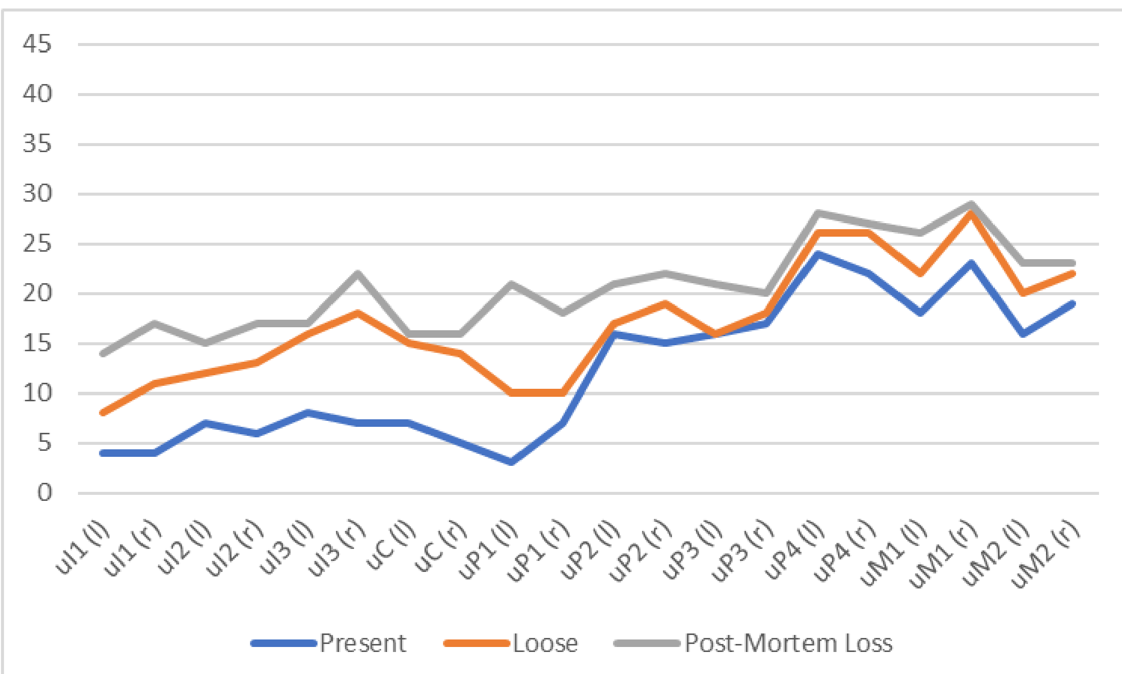

Fig. 4.25. Percentage of surviving loose and in-situ maxillary teeth, against teeth lost post-mortem.

Figs. 4.24 and 4.25 show that most surviving teeth were found within the mandible or maxilla. This is hardly surprising, as loose teeth are much more likely to be missed by excavators (Payne 1972: 59-61). However, the percentage of loose teeth varies greatly: teeth in more robust parts of the mandible or maxilla, such as the first molar, are rarely found loose. Yet canines and incisors are often found loose: this is likely because the front part of the head is more often damaged or lost than the back. Premolars and molars are more firmly rooted in the socket, with multiple roots, than canines or incisors which have only a single root (Colyer 1990: 15). Post-mortem tooth loss mostly affects the first and second premolar and mandibular third molar. They originate from the parts of mandible/maxilla that survive well, but in dogs these teeth have less roots than other molars and easily lost. All in all, the majority of missing teeth were lost post-mortem due to taphonomy. A small number, however, were lost *before* the dog died: these will be discussed in 6.2.

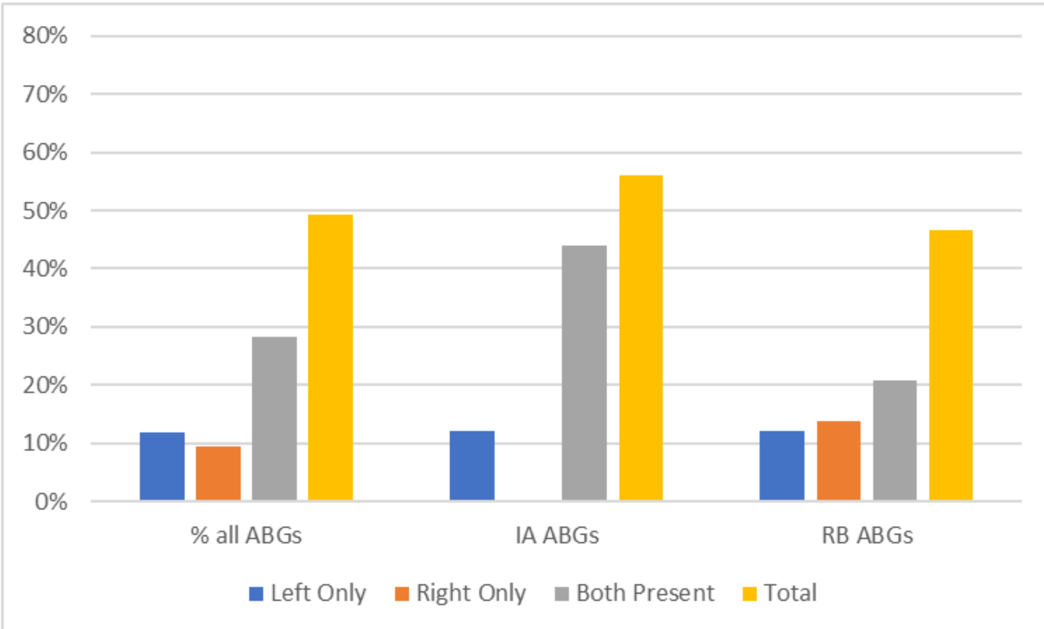

Fig. 4.26. Overall ABG presence for scapula, by phase.

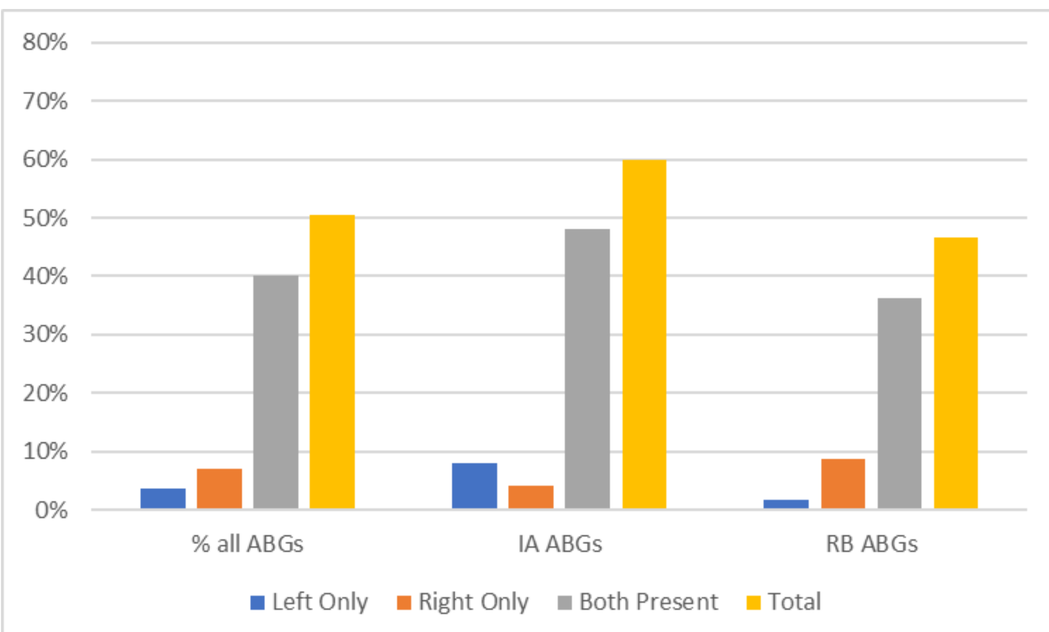

Fig. 4.27. Overall ABG presence for pelvis, by phase.

The two zoned trunk elements, the pelvis and scapula, had similar percentages of survival to one another, but were better preserved in Iron Age ABGs than Roman (see Figs. 4.26 and 4.27). Certain parts of the scapula and pelvis are fragile and rarely survive in both phases (see Figs. 4.28 and 4.29), particularly the pubis (zone 6).

Fig. 4.28. Scapula zone survival for ABGs.

Fig. 4.29. Pelvis zone survival for ABGs.

The Limbs

The fibula was excluded from this analysis due to its fragility and generally poor survival. The remaining limb bones showed similar patterns of survival, both as whole bones and as individual zones. Overall, limb survival was good: (see Fig. 4.30) each bone was present in between 56% and 64% of ABGs. Pairs were present in around a third of ABGs. There is a small amount of variation in the number of ABGs that have only right limbs survive, but testing shows no significance ($\chi 2 = 5.05$, df = 8, $p = 0.75$). There are no notable differences between the front and hind limbs.

Interestingly, the ulna survives just as well as the larger and more robust long bones; however, it is far less likely to survive intact. The fragile distal end is very likely to break off and be lost, with less than half of the bone surviving below Zone 6 (see Fig. 4.31). The proximal epiphyses of the ulna and epiphyses of other long bones do not survive as well as the shaft, but the difference is usually 10% or less. Poor recovery may be the cause of this in subadult and younger dogs (as the epiphyses are unfused), which make up 20% of ABGs.

Limb bones are more complete in the Iron Age than the Roman period (Fig. 4.32), significantly so ($\chi 2 = 5.77$, $df = 3$, $p = 0.0097$). The proportion of ABGs with at least one limb do not vary greatly between the phases, but many more Iron Age dogs have complete limb pairs than Roman dogs. Therefore, limb pathology is somewhat easier to diagnose in the former; unilateral or bilateral pathology can have different aetiologies.

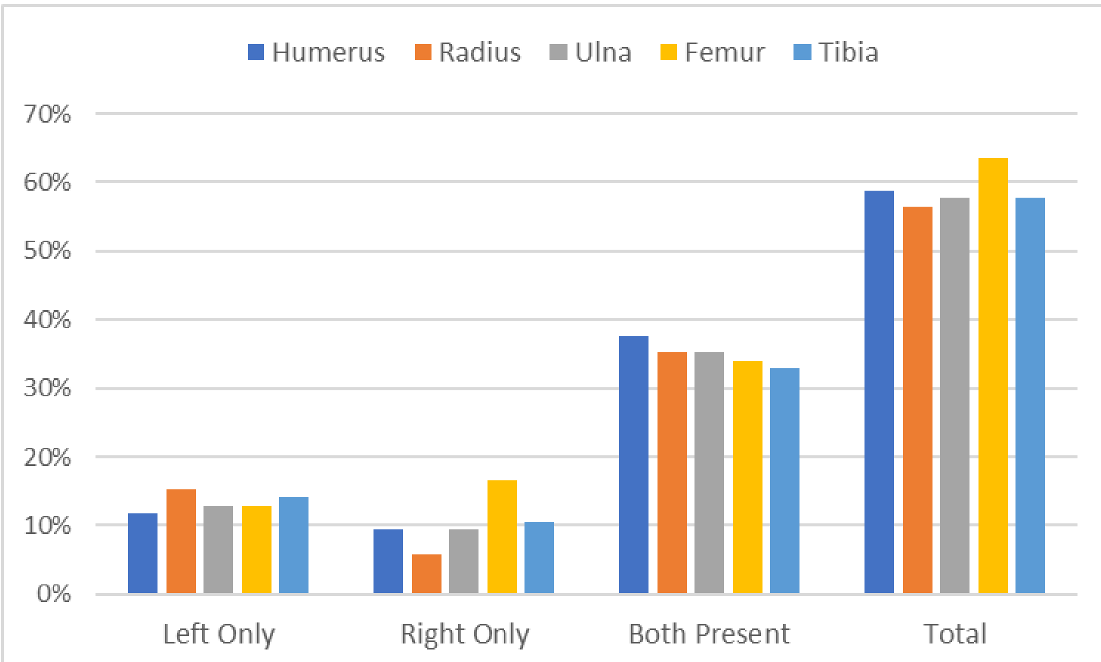

Fig. 4.30. Relative frequencies of limb survival (as % of ABGs) sorted by sub-group and total.

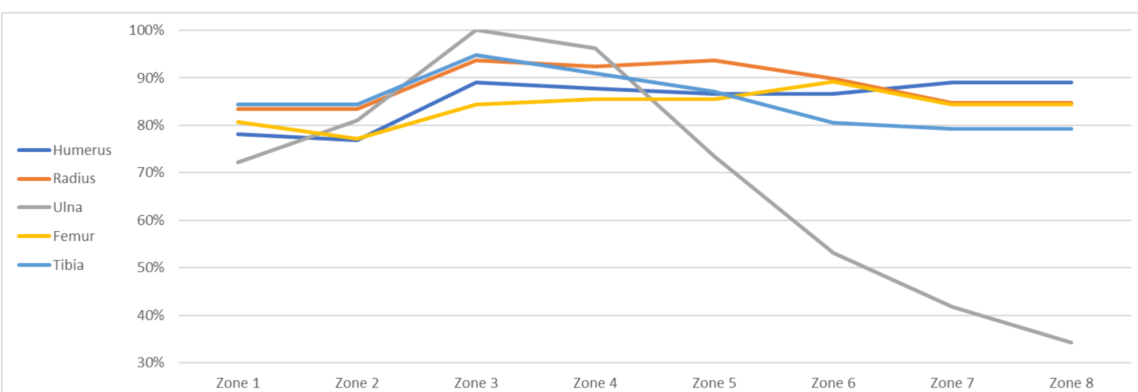

Fig. 4.31. Survival of ABG limbs by zone, as % of total surviving limbs.

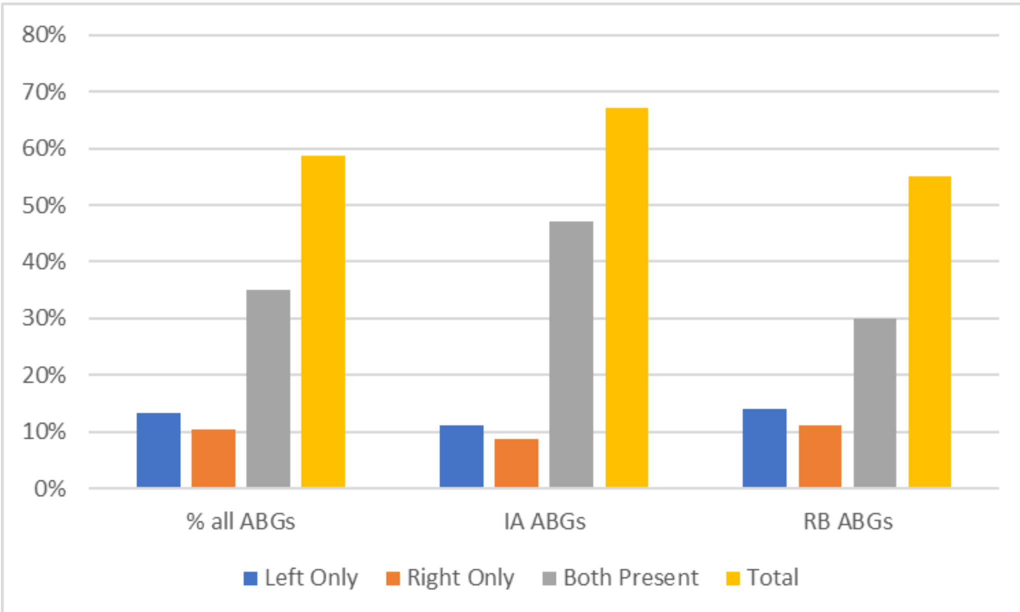

Fig. 4.32. Difference in total limb survival by phase (as % of ABGs).

Section Summary

In general, there is a good percentage of survival in major elements, and they are likely to be recovered intact. The bones appear to survive slightly differently between the Iron Age and Roman periods. Although this cannot be said of all elements, those that were studied by zone had similar survival; denser parts of the bone were represented more frequently than more fragile parts. Surprisingly, Roman ABGs had a higher relative frequency of survival for some of the more fragile zones, despite the fact they were less likely to be recovered than in the Iron Age. This may affect my ability to identify pathology between phases (and on more fragile zones).

The data confirms that overall bone survival will have the greatest effect on pathology identification. Lesions that affect articular surfaces (including osteophytes) may be under-represented in the sample, due to the lower survival of the long bone epiphyses. There are anatomical parts that are under-represented, such as the iliac portion of the pelvis, but this is unlikely to have a major effect on pathology. In terms of whole elements, the skull is under-represented relative to the mandible, particularly in the Roman data. Limb pathology will not be biased towards any one limb, aside from the distal ulna, which will be under-represented. Overall, pathology may be slightly more under-represented in Roman ABGs than Iron Age individuals, particularly in the skull, limbs, paws and joints.

Dental pathology may under-represent conditions that caused teeth to be lost near death (thus leaving little time for the alveolus to heal), and lesions on canines and incisors. They may also be under-represented in general, unless they left signs on the mandible (such as alveolar recession), due to the high number of teeth lost in the archaeological record.

4.3.3. What's Left? Associated Bone Group Treatment After Death

The ABG analysis so far has focused on dog characteristics, such as size and age and how their bones survived from Iron Age to Roman Britain in general. But it is not only dog numbers, morphotypes and physical conditions that may have changed, but also how they were treated after death. Their bodies may have been deposited, or even utilised, in a different way through time. This can be apparent in the condition they are as ABGs: not only their overall preservation, but the prevalence of butchery or gnawing. Several attributes recorded for the ABGs may be of particular help here and are considered in turn.

Butchery

Butchery was uncommon in both time periods. Six ABGs had cases of butchery: four from the Iron Age (16% of ABGs), and two from the Roman period (4%). One other case, from Greyhound Yard (GY-18), is uncertain: two fragmented rib bones show repeated cutmarks across their shafts. As the dog was quite large (58cm height at withers) and sheep remains were found in the same bag, they could not be confirmed as dog.

Although they look large as percentages, the lower absolute frequency of butchery requires Fisher's test to be used. It indicates this difference is not quite significant with a p-value of 0.064. Interpreting this result is tricky, as counting the Greyhound Yard ABG as having butchery then raises the p-value to 0.19, a value far from significant. It is possible but tenuous that butchery occurred more in Iron Age dogs than Roman.

All butchery comprised fine cuts, usually on the limbs. As Fig. 4.33 shows, rib and spinal butchery were present but rare. Most cases were judged to be from skinning the body, but at least one ABG may have been defleshed for meat. Some unusual marks on one Iron Age ABG, HD-2, show that the dog may have been disembowelled: it has multiple cuts across the ventral side of the transverse process in both the lumbar vertebrae and the sacrum (see Appendix C).

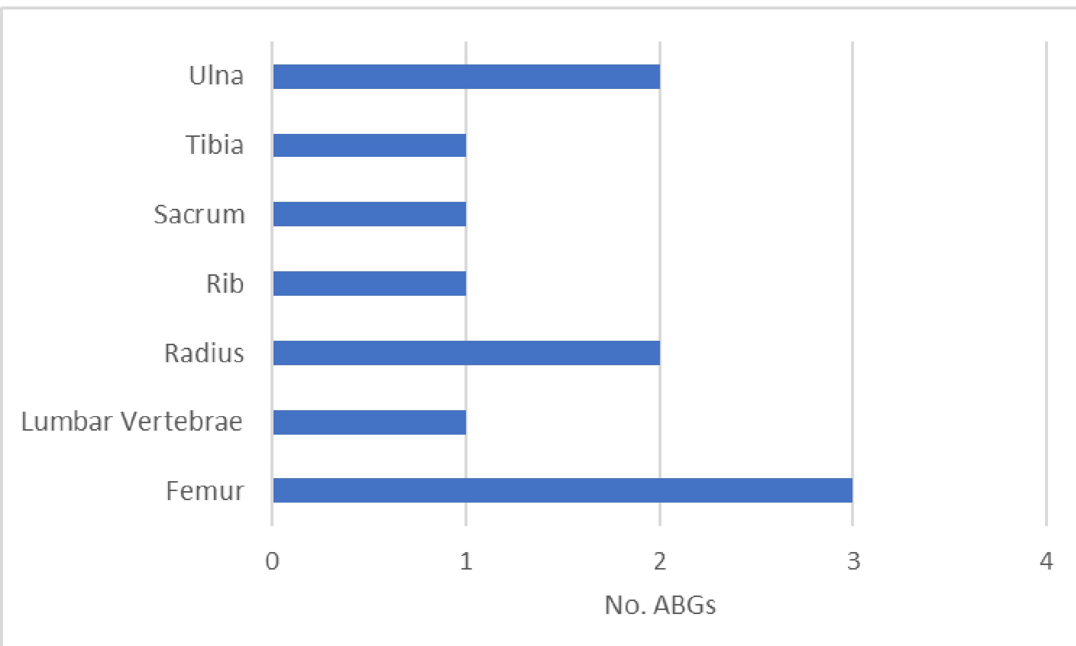

Fig. 4.33. Number of ABGs with butchery present, by bone.

Preservation

Bone preservation (separate from bone *survival*; see 3.7), did not show any major changes between the two time periods. Fig 4.34 shows there are slightly more dogs of particularly poor or excellent condition in the Roman period, but the two distributions are otherwise quite similar. However, the sample sizes are small and the difference is not statistically significant ($\chi2 = 2.45$, df = 3, $p = 0.48$). More data is needed to investigate preservation differences between the phases.

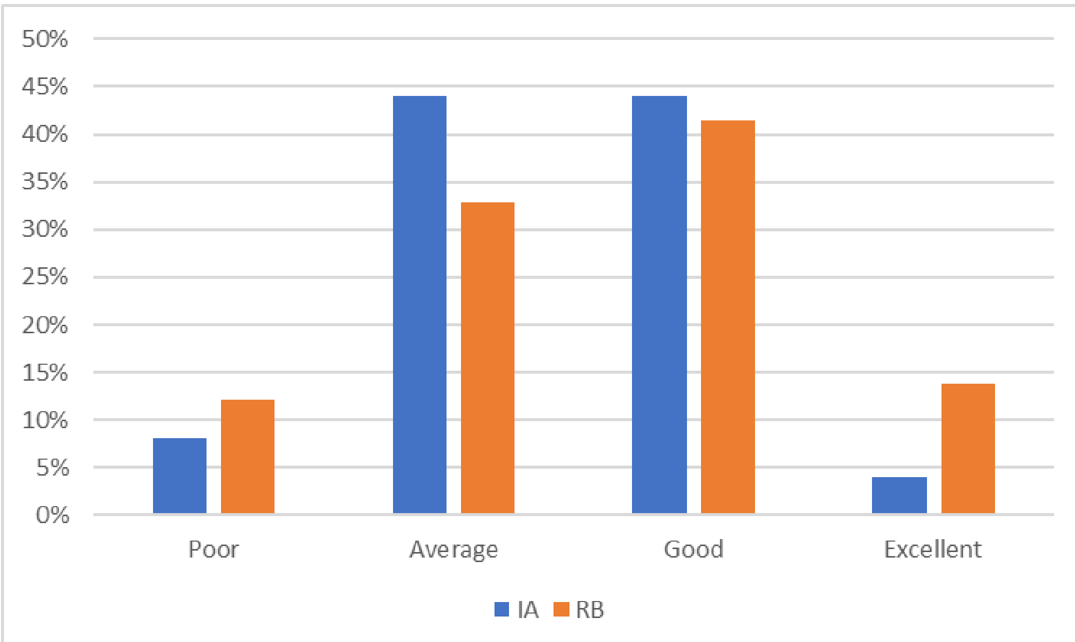

Fig. 4.34. Percentage of ABGs in each preservation category, sorted by phase.

Gnawing

On the other hand, there was a noticeable shift in the frequency of ABGs that showed signs of gnawing. Amongst the Iron Age specimens, only three (12%) had gnawing; the Roman ABGs had somewhat more at 12 (21%). However, it is not statistically significant; chi-square testing gives a p-value of 0.36 ($\chi2 = 0.89$, df = 1). As with gnawing there is no difference between the two periods in this dataset but it is possible that, with a larger sample, significant differences may be found.

Deposition

Many of the ABGs lacked detail about their burial. The context name and type of deposit were always available, but other details were frequently missing, including placement within the deposit, and presence of other animal bones or material goods. A few ABGs, particularly from Caistor and the smaller Iron Age sites, had detailed information but others were unknown. Although some ABGs were found with other animal bones in the same bag (see the 'Notes' section in the database in Appendix D), not enough was known about the contexts to assume the dog was *deposited* with other animals. In many cases, such as Owslebury, later redeposition or the context being crushed from above (Maltby 1987b) obscured the original deposit.

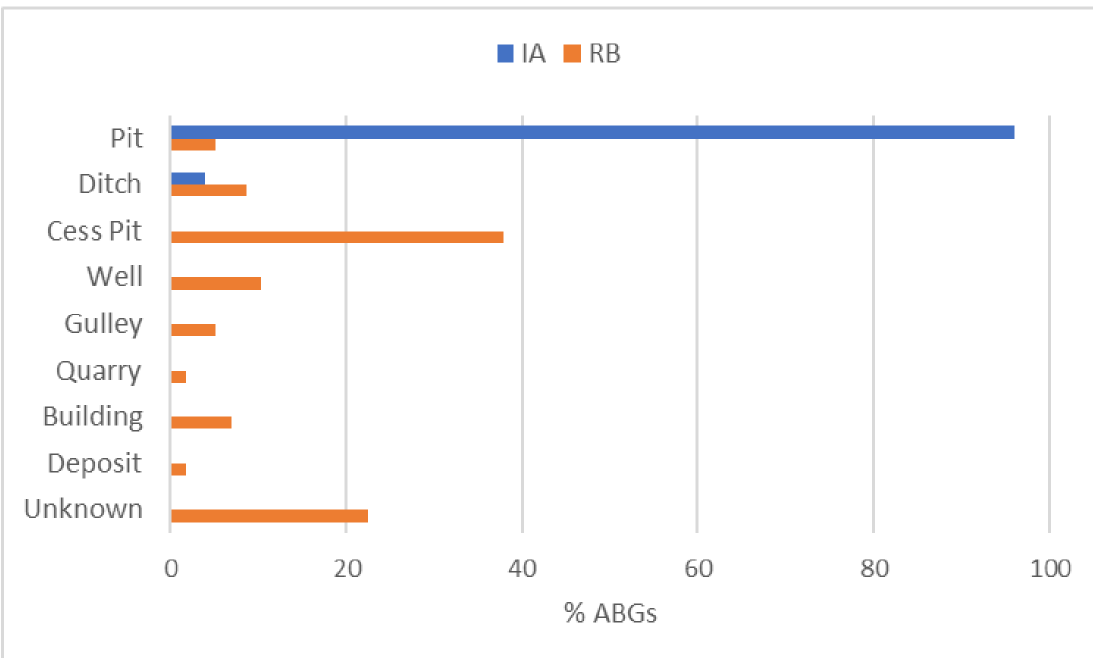

Fig. 4.35. Number of ABGs per context type for the Iron Age and Roman periods.

Most dog ABGs were buried in pits, but other types of context were used, particularly in the Roman period. Fig. 4.35 outlines the change in context type: all but one Iron Age dog were buried in pits, while 20 of 58 Roman dogs were buried in ditches, quarries, features, deposits, buildings and wells. The latter is particularly interesting, especially as other authors have noted this to be a Roman practice, and potentially ritual activity (Hambleton

2006; Roskams *et al.* 2013). 13 Roman ABGs belonged to unknown deposit types, specifically from Baldock and Fishbourne, where only context names and deposit dates were available.

Many Roman dogs were noted to be buried in cess pits rather than pits. Typically, cess pits refer to pits used for waste, specifically human waste, and indicator 'packages' of biological and archaeological evidence have been developed to identify them (Hall and Kenward 2016; Smith 2013). These dogs came from Owslebury and Greyhound Yard, but the reports do not discuss the exact criteria used for distinguishing regular pits from cess pits (Maltby 1987b; 1990); both were noted to be filled with substantial numbers of animal bones. Thus, there is a certain amount of ambiguity as to how differently each were used or if one could be mistaken for the other. While Maltby notes that several cess pits contained infills of rubbish and dogs were more likely to be buried in the lower fills (1990: 7; 60), it is possible that regular pits were used in a similar way. Given that many of these cess pits contained huge numbers of animal bones, it is possible they were not used for human waste for long, and perhaps not regarded much differently from other pits. Overall, how substantially pit deposition changes from the Iron Age to Roman period is unknown. It is even possible (though perhaps unlikely) that Roman pits are more likely to be labelled as cess pits than Iron Age.

4.3.4. The Challenges of Age

Fig. 4.36 outlines the age distribution for the Iron Age and Roman ABGs. As 3.2.5 notes, the non-adult dogs were determined using bone fusion, and both fusion and tooth wear for the adult dogs. If a dog is adult but no tooth wear data is available, then it was noted as generic 'adult'.

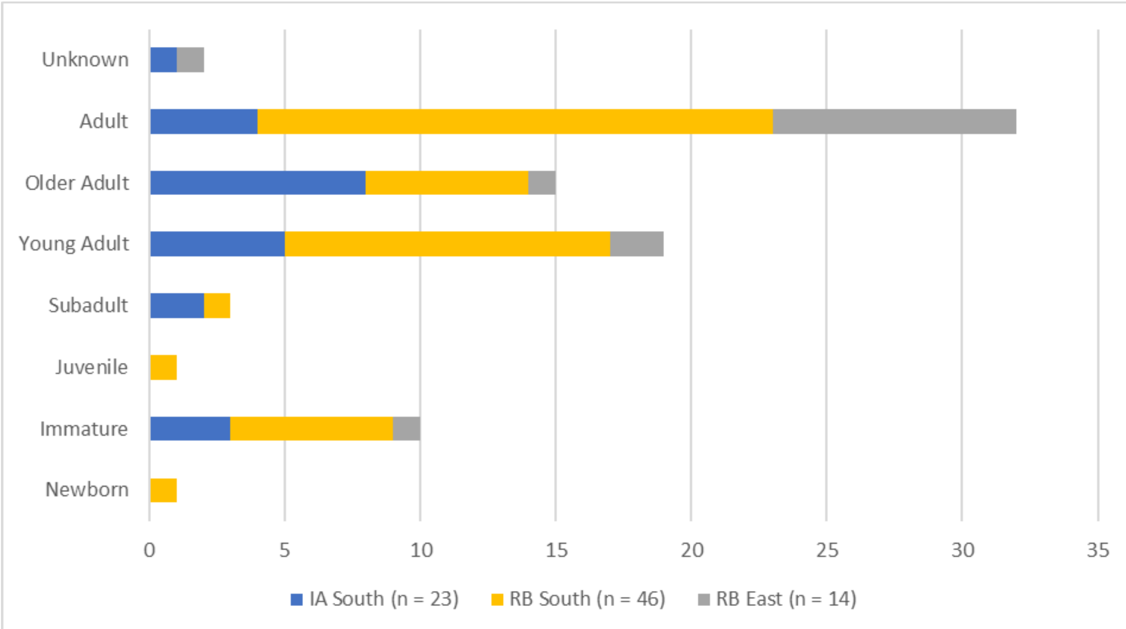

Fig. 4.36. Iron Age and Roman ABG ages, categorised by overall group.

As adult dogs were prioritised for study, and puppies are less likely to survive in the archaeological record, the data are not representative of the death assemblage. However, the adult results are much more interesting. The Roman South has approximately two young adults for every older adult, and although a small dataset, the Roman East data is congruent with this. Yet the Iron Age dogs from the South have 60% more older individuals than young adults.

However, there are issues with using tooth wear: the differences may be due to diet rather than age. Both Iron Age and Roman flour contained grit, the levels varying depending on the millstone used. This wore away at the teeth of many people in Roman Britain (Alcock 2006: 177; 245-246). Thus, dogs that ate a high amount of carbohydrates may also have experienced a higher rate of tooth wear compared to those that ate more meat. Sykes notes that dogs had higher-protein diets overall in the Roman period than the Iron Age (Sykes 2014: 142-43), thus potentially leading to a slower average rate of tooth wear in Roman dogs. Examining the tooth-wear stages more closely adds extra doubt. As Table 4.11 shows, most young adults in the Iron Age samples had more advanced tooth wear than those from Roman contexts.

ID	Site Name	IA/RB	M1 Stage
DA-8	Danebury	IA	B/C
BC-3	Balksbury Camp	IA	C
DA-4	Danebury	IA	C
HD-1	Houghton Down	IA	E
DA-10	Danebury	IA	E
CA-1	Caistor	RB	A
OW-12	Owslebury	RB	A
BAL 485-1	Baldock	RB	B
OAK-1	Oakridge Well	RB	C
OAK-3	Oakridge Well	RB	C
OAK-4	Oakridge Well	RB	C
OAK-5	Oakridge Well	RB	C
OW-16	Owslebury	RB	C
OW-7	Owslebury	RB	D
OW-5	Owslebury	RB	D
OW-18	Owslebury	RB	E

Table 4.11. Table of tooth-wear stages for Iron Age and Roman young adult ABGs.

4.3.5. Size and Shape

There are clear differences in dog height between Iron Age and Roman individuals. The range of dog measurements is much wider for the latter, and has a far greater number of individuals that are small in size (<35cm; see Fig. 4.37). The large number of small dogs in the Roman period, particularly relative to the Iron Age is also noted elsewhere in Britain (Bellis 2018; Harcourt 1974) and elsewhere in the Roman Empire (Bartosiewicz 2000; Colominas 2016).

Proportionally, more Iron Age dogs fall into the large end of the medium (35-50cm) category, although testing with Mann-Whitney reveals no significant difference in medians between the two datasets ($U = 158$, $z = -1.44$, $p = 0.15$). Both periods have a similar proportion of large (>50cm) dogs.

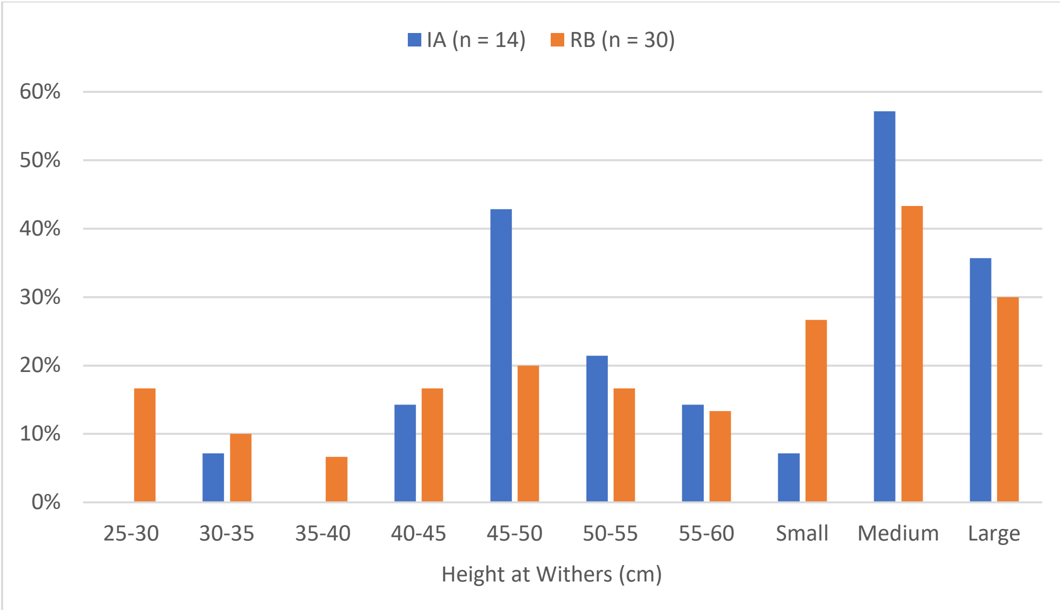

Fig. 4.37. Range of dog heights at withers for Iron Age and Roman dogs.

When size is compared against shape, considerable overlap between the two time periods is evident: the Iron Age does contain slender and more robust dogs of varying sizes. However, the Roman period contains, on average, much slenderer medium-sized and large dogs, alongside particularly robust smaller individuals. A cluster in the bottom right of Figs. 4.38 and 4.39 is evident, consisting of small-to-medium dogs with an SI of 10 or more. All of these dogs displayed some degree of bowing, likely due to chondrodystrophy (dwarfism) that causes disproportionately short and twisted limb bones. There are very few small, particularly slender dogs. The additional ABGs from Caistor and Baldock are relatively similar in shape to the dogs from the south, aside from several small, slender individuals. The sample sizes are too small to assert this as potential regional difference. It does, however, show that a few smaller dogs within England were within the range of standard shapes, but that most had some degree of bowing.

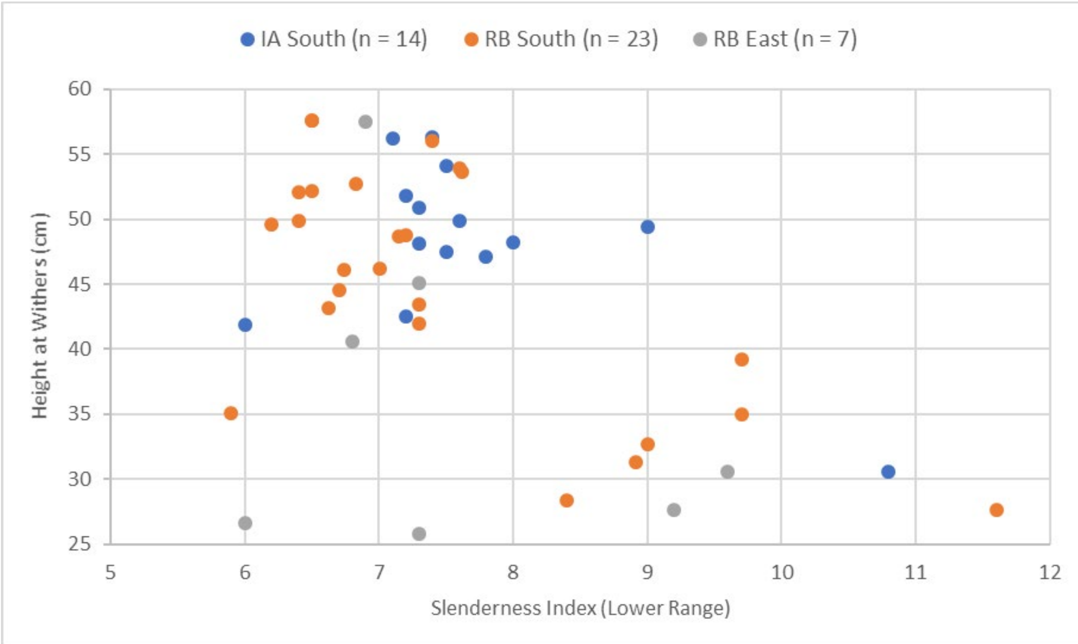

Fig. 4.38. Comparison of dog height and lower range of Slenderness Index (SI).

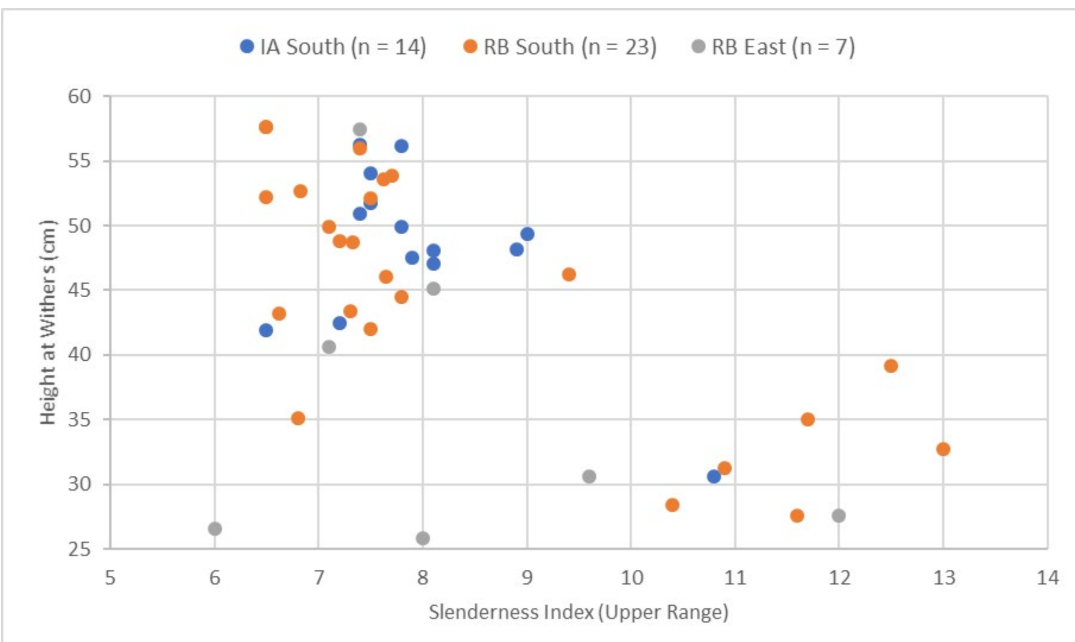

Fig. 4.39. Comparison of dog height and upper range of Slenderness Index (SI).

Unfortunately, too few skulls survived sufficiently intact for full-scale comparative analysis. Only three ABGs could be measured for total skull length (Harcourt I) and subsequent calculation of the cephalic and snout indices. However, 22 ABGs had mandibles in sufficient condition to take M1 measurements and mandible toothrow length (Harcourt XV) measurements. The latter shows some difference between the Iron Age and Roman material: the Roman mandibles are, on average, shorter in the middle range. When tested with Mann-Whitney, however, these medians are not significantly different ($U = 38.5$, $z = -1.3$, $p = 0.19$). On the other hand, there is less difference in the 50-60mm range: for the Roman material, there are fewer short mandibles than there are short dogs. The M1 measurements (see Figs. 4.40 and 4.41) greatly overlap for both periods, aside from a couple of Roman outliers. This is a very interesting contrast to the withers data: it suggests that most small dogs had short limbs but similarly-sized mandibles and teeth to taller individuals, rather than being evenly proportioned.

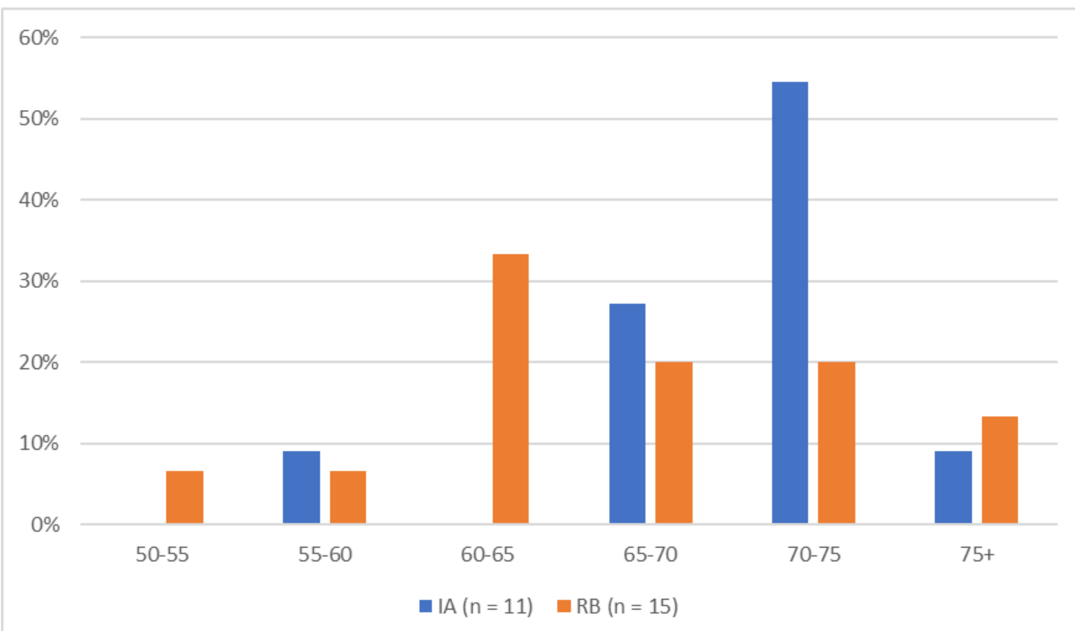

Fig. 4.40. Range of measurements for mandible toothrow length.

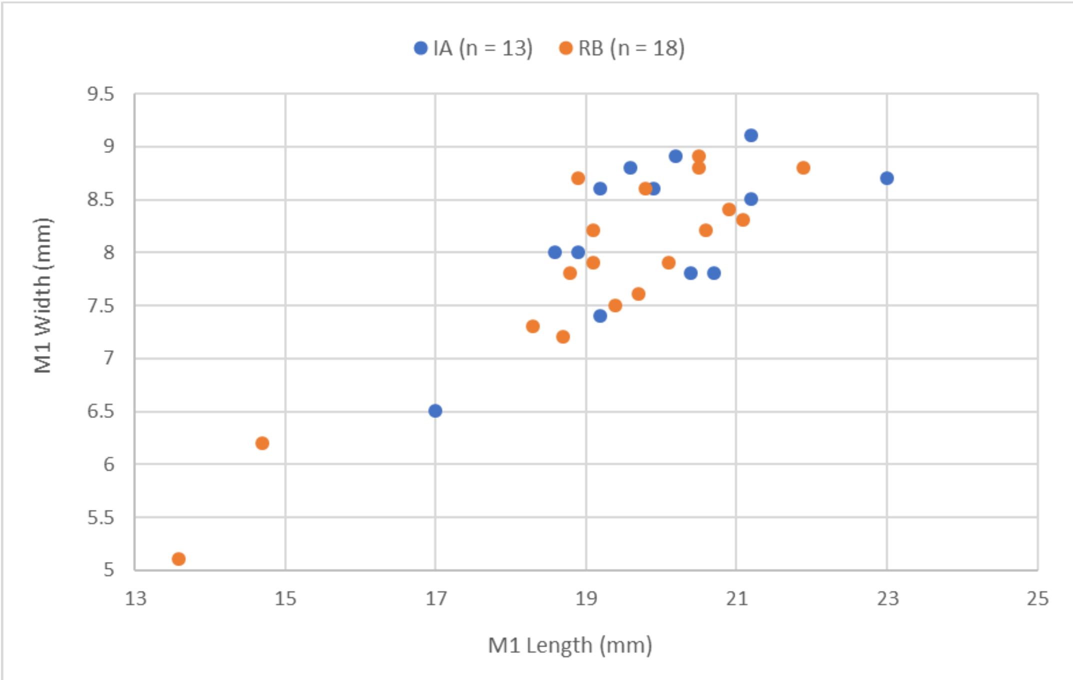

Fig. 4.41. Range of measurements for M1 length and width.

4.3.6. Summary of Associated Bone Groups

There are several clear differences between Iron Age and Roman dog ABGs (see Table 4.12 for synthesis). The first, and most obvious is size: except for one dog, all small dogs belong to Roman contexts. Age and diet also vary, although it is not yet clear which factors are responsible for this difference. Either dogs had longer lifespans in the Iron Age, or had much poorer diets, or potentially a mix of both. These changes are evident in both southern and eastern England.

Overall, Iron Age ABGs were more complete specimens than Roman ABGs. This is despite that fact they had no major differences in preservation, butchery and overall proportions that survived to become ABGs (see 4.2). The fact that the former were gnawed less often suggests that they were less likely to be exposed to scavengers and other forms of damage, and that this may be responsible for the differences in their survival rates. In essence, they were likely buried more rapidly and/or with more purpose.

	Key Differences between Iron Age and Roman Periods
Skeletal Completeness	All ABGs were recovered with at least 50% of bones missing, and nearly half lost 90%. However, Iron Age dogs have a significantly higher survival frequency than Roman dogs. This applies to all major elements, particularly the skull.
Gnawing and Preservation	No major differences in preservation, except a slightly higher frequency of Roman dogs that were in particularly poor or excellent condition. More Roman dogs showed signs of gnawing than Iron Age, but the difference was not statistically significant.
Deposition	Nearly all Iron Age ABGs were deposited in pits. By contrast, Roman ABGs were deposited in a wide range of context types, including pits ditches, wells, cess pits, gulleys and buildings.
Butchery	Butchery uncommon in both periods and affects few ABGs, but is more common in the Iron Age. Difference is not, however, significant. Most cases associated with skinning, not defleshing. An Iron Age dog, HD-2, has very unusual butchery marks that suggests disembowelling.
Age	By tooth wear, the Iron Age had more older adult ABGs than Roman. However, many Iron Age 'young' adult ABGs had more advanced tooth wear than their Roman counterparts, meaning that dietary difference may affect tooth wear more than age.
Size and Shape	Most dramatic differences between ABGs. Roman period has a number of small dogs (withers height <35cm) of various shapes, including some with chondrodystrophy (dwarfism). Iron Age dogs are nearly all medium to large, with the exception of one small dog that dates to the Late Iron Age.

Table 4.12. Summary table of ABG phase results.

In both time periods some dogs were buried before they could be scavenged, while others were exposed to the elements after death. But was this difference due to the sites themselves, and not the time period that they were active? This is always possible. The larger sites, particularly Danebury, Oakridge, Owslebury and Greyhound Yard, had high numbers of ABGs that were in heavily damaged, mixed deposits, or were only an articulated limb or two.

Continuity is also evident. Although overall patterns in dog size and shape exist, many similar morphotypes of medium sized and large dogs were recovered from both periods. While some Roman ABGs were deposited in other types of context, many were still buried in pits.

4.5. A Subtle Transition

	Key Results
4.1: Overall change through time	Dog numbers change little between the Iron Age/Roman transition. The majority of change (albeit modest) is a drop between the Early/Middle Iron Age and the Late Iron Age, and a gradual rise in dog NISP and %NISP across the Roman period, particularly the Late Roman. ABG numbers vary little through time, and all phases have a similar pattern for dog ABGS. Most sites have only one dog ABG, which is usually the only ABG on site. Smaller numbers have more than one dog ABG, with the site frequency inversely proportional to the number of dog ABGs.
4.2: Other factors through time	Modest differences between different settlement types, although %NISP patterns through time generally follow overall trends. Possible ABG differences between settlement types, particularly hillforts and military sites, but more data needed to ascertain. Dog ABGs generally more numerous on urban than rural sites. No major differences found between villa and non-villa sites, and settlements of different sizes.
4.3: ABGs through time	Iron Age dogs were significantly more complete than Roman and deposited in less diverse range of locations, being almost exclusively recovered from pits. Similar preservation and low frequency of gnawing for both periods. Butchery rare for both phases, albeit slightly more common in Iron Age dogs. Significance cannot be commented on, given tiny sample size. More Iron Age dogs reached later adulthood, according to tooth wear analysis. However, results are uncertain, as tooth wear may be more rapid in dogs with more grit or rough food in their diet. The most dramatic difference between Iron Age and Roman datasets is the difference in size and shape: many Roman ABGs were small animals of various shapes, whereas only one Iron Age dog was shorter than 35cm.

Table 4.13. Summary table of key chapter results.

The transition from the Iron Age to the Roman period is, in canine terms at least, a rather mixed event. Unlike the dramatic dietary shift from sheep to cattle and pigs (King 1999b: 182-83), the results (synthesised in Table 4.13) do not show a sweeping change though the Roman occupation of Britain. Instead, we see some attributes that change significantly, others that change modestly, and many that do not change at all. If we begin with the most certain changes, we can see that the morphotypes of dogs changed dramatically. Aside from one dog from the Late Iron Age, all dogs below 35cm in height originate from Roman contexts. These include both ‘dwarf’ dogs that suffered from chondrodystrophy, and very small, gracile dogs that were more evenly proportioned. This supports Harcourt’s assertion that dog sizes became more diverse in the Roman period

(1974). On the other hand, many medium-sized dogs are present in Roman contexts, with similar physiology to those from the preceding Iron Age. Overall, dog morphology is a significant change, but not a wholescale transformation.

How deposition changed between the two periods is, as discussed, modest but noteworthy. Iron Age dog ABGs are better preserved than their Roman counterparts, with fragile elements more likely to survive in the former. While the difference is statistically significant, part of the reason may be due to the poor preservation of dogs on Roman Greyhound Yard, which contained 21 ABGs. However, even dogs on other Roman sites are generally preserved less well than Iron Age ABGs, so other factors are involved. It is possible that deposition practices changed through time, albeit subtly. This idea is supported by the fact that context types in which dogs were recovered changes: nearly all Iron Age dogs were purposefully deposited in pits, whereas some Roman dogs were buried in ditches, under buildings and in wells. Other supporting evidence is the small rise in gnawing between the two periods, although the increase is not statistically significant and needs more data to confirm.

The smallest change seen is the numbers of dogs through time. They existed in all temporal periods across the Iron Age and Roman periods, and all types and sizes of settlement therein. Few changes were found between phases and these were usually not statistically significant. The greatest shifts occurred *within* phases: the drop in NISP across the Iron Age and rise in the later Roman phases. The former is a less reliable result and needs more data to strengthen the interpretation. Change through time by individual settlement type, or features such as size or villa buildings, is small. Military and urban sites have a small but significant rise in dog NISP through the Roman period, but settlement types only vary from one another significantly in the Middle Roman phase. The only other difference of note is that urban and military sites have a higher proportion of dog ABGs than rural settlements through all phases. Some practices did not change at all. Butchery remained rare in both periods, and was mainly associated with skinning, not defleshing for meat. The act of eating dogs (cynophagy) may have happened in only one case, and even then it is not certain that the dog was defleshed for *human* consumption. It may have been defleshed as part of an unusual ritual (where the meat may not have been consumed at all) or for feeding to a carnivore.

All in all, this chapter has refined and built upon previous work, while offering a much wider range of results for interpretation. As mentioned at the beginning of this chapter, previous studies on dogs in Roman Britain have focused on fairly narrow types of evidence or case studies. The debate between Harcourt (1974) and Clark (2000), on whether Iron Age morphological diversity is narrow relative to Roman, has been investigated in more detail. Morris' (2011) chronologically broad work on ABGs in Britain has also been refined: the rise in dog ABG numbers (relative to other animals), upon closer examination, may be partially due to Roman urbanism and military occupation.

What these results may mean for human-dog relationships, and how they changed from Iron Age to Roman Britain, is a question I will reflect on after analysing the rest of the collected data. An aspect of human-dog relations that this chapter has touched on, but not explored fully, is how different regions may have changed in response to the Roman conquest, and their previous cultural attitudes. The next chapter re-examines the secondary evidence using regional boundaries as the lens.

Chapter 5: Dogs Through Space, From Rome to Dorchester

When the Romans arrived in AD 43 Britain was not a homogeneous island with its inhabitants united in a single group. Caesar and Tacitus' accounts of the Britons depict a fractured, often conflicting, series of groups and confederations (Caes. *BGall*. 4-5, 5.11; Tac. *Ag*. 11-12). The accuracy of their accounts is debatable, with the archaeological evidence finding congruence in a few areas (e.g. epigraphy and select material goods; Mattingly 2006 69-70; Smith and Fulford 2016: 403) and a lack of evidence in others (particularly *civitas* and tribal boundaries; Smith and Fulford 2016: 402-403). Yet it shows the authors were correct on one thing: there were many different cultural groups. They had different values and left behind different artefacts. From the striking coins of the southern and eastern groups (Creighton 2000: 28-30), through to the more subtle expressions of wealth through animals and the agricultural landscape in the North (Taylor 2013: 182-186), the archaeology is remarkably diverse.

Dietary choices have also been well studied, particularly after the Roman Conquest. They show that, even after Britain was officially incorporated into the Empire, people had local preferences. The Roman military preferred to eat beef and pork over mutton (King 1984; 2001). In places they conquered, much of the diet changed to meet this preference (Groot and Deschler-Erb 2017; Groot 2008; Lyublyanovics 2010). Yet in Britain, people in certain parts of the province took to this new diet more readily than others (Allsop 2014: 83; King 1999b: 179-181). Eastern groups reared more cattle than those from central or north-east parts of the island (Smith and Fulford 2016: 399).

Dogs were not eaten (at least not regularly) but found in every part of the island, regardless of current or former group affiliation. But were they more important in some groups and places than others? Until now, this has been a tricky question to answer. Most dog studies have focused on small datasets (Baxter 2006; 2010; MacKinnon and Belanger 2006) and even larger studies (Clark 1995; Harcourt 1974; MacKinnon 2012) have been unable to settle the issue. They show clear change through time, but not space.

Recent ‘Big Data’ projects (cf. 3.1.2) have produced a large volume of animal bone data that may help answer this question. The largest of these, the Roman Rural Settlement Project, divided all of its data into seven regions: the Central Belt, Central West, East, North, North East, South, and South-West. Using these regions, I will explore the Iron Age and Roman dataset (see 3.1.2). Just as relative numbers of cattle, sheep and pigs have been studied by others, I will compare the number of dog bones and more structured ABG deposits. Ancient texts and statistical testing against other factors will later help place these results into context; human-dog relationships cannot be fathomed through bone numbers alone.

5.1. Reviewing the Regions

5.1.1. Number of Identified Specimens by Region

Region	No. Sites	No. Site Phases	Phases w/Dog Remains	% w/Dog Remains	Total Dog NISP
Central Belt	185	366	303	83	8413
Central West	13	26	22	85	511
East	46	96	78	81	2692
North	6	26	22	85	306
North East	29	73	56	77	5104
South	129	306	277	91	31347
South West	3	7	6	86	95

Table 5.1. Table of key site and site phase numbers.

Although the seven RRSP regions were divided evenly, the number of sites with animal bone (of NISP >400) contrast greatly (see Table 5.1). The South West is smallest, with only three sites and seven site phases that meet the criteria. The two most populous, the Central Belt and the South, have over a hundred sites apiece and over 300 individual site phases.

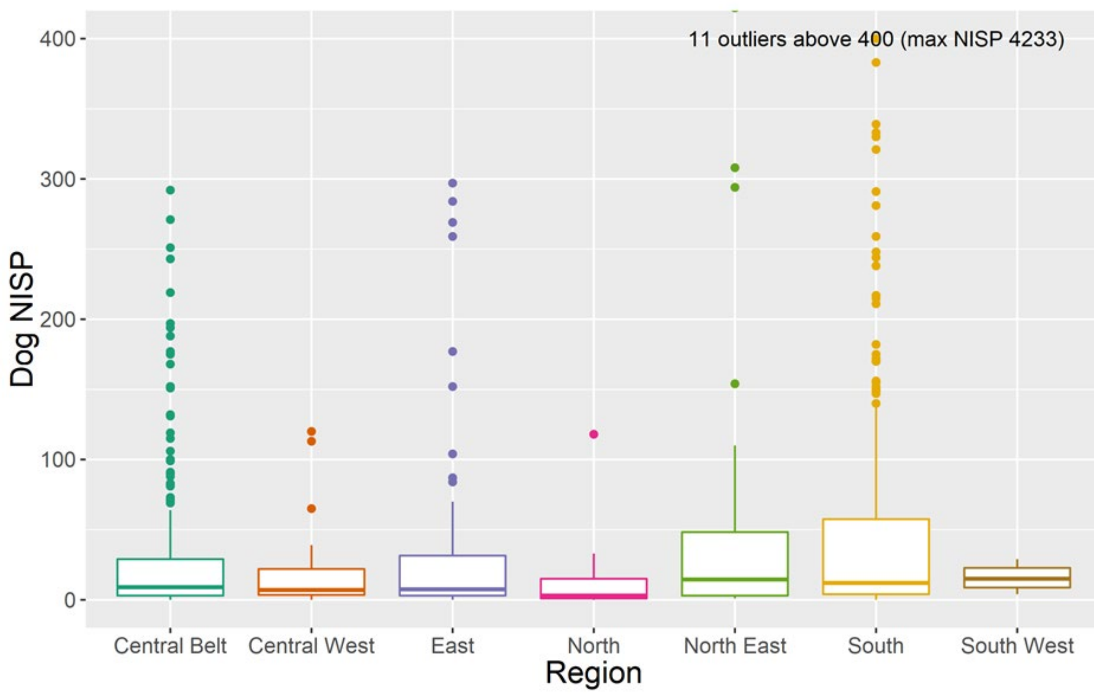

Fig. 5.1. Boxplot of dog NISP numbers.

This variability shows in Fig. 5.1, which depicts the range of NISP on sites with at least one dog bone. The three smallest regions, Central West, North and South West have much smaller data ranges, reflective of sample sizes that are too small to be reliable. The remaining four regions have similar data ranges, with a wider ranged third quartile than the first. Thus, the data are not normally distributed. While the first quartiles are less variable overall, they vary less between the Central Belt and East than the other two main regions. Subsequently, they have lower medians. Following a similar pattern, the Northeast and South have larger, more variable third quartiles and 'whisker' lengths; the top half of NISP values are, on average, greater than the other regions.

Outliers are common in the largest regions. Despite the lower median and range for most sites in the Central Belt, it still has a considerable number of outlier sites, ranging from 75-300 NISP. As Table 5.2 shows, even larger outliers range from 500 to 4,000 dog bones and affect the 'Total Dog NISP' counts of Table 5.1; despite having 60 more site phases, the total NISP of the Central Belt is nearly a quarter of the South's. A similar trend is present in the other two ‘main’ regions. Although the East has 23 more site phases, the North East has nearly twice as many dog bones in total.

Site Name	Region	Settlement Type	Phase	Phase NISP	Dog NISP
Owslebury	South	Rural Settlement	LR	16489	4233
Greyhound Yard	South	Urban	MR	9418	2204
Oakridge II/IV, Basingstoke	South	Rural Settlement	LR	10115	2101
Oakridge II/IV, Basingstoke	South	Rural Settlement	LR	6194	1760
Danebury 1984	South	Hillfort	IA	57605	1721
Bainesse Farm	North East	Rural Settlement	R	49635	1372
Dalton Parlours	North East	Rural Settlement	LR	4791	1350
Danebury 1991	South	Hillfort	IA	46358	1285
Greyhound Yard	South	Urban	ER	13693	960
Greyhound Yard	South	Urban	ER	3747	771
Danebury 1991	South	Hillfort	MIA	35081	745
Houghton Down	South	Rural Settlement	EIA/MIA	3691	613
Balksbury Camp 95	South	Rural Settlement	MIA/LIA	6263	604
Oakridge II/IV, Basingstoke	South	Rural Settlement	ER	1817	537
Danebury 1984	South	Hillfort	MIA	8007	502
Owslebury	South	Rural Settlement	LIA/ER	14923	486
Danebury 1984	South	Hillfort	MIA/LIA	26860	467
Greyhound Yard	South	Urban	LR	7579	466
Flagstones	South	Rural Settlement	LIA	2571	442
Piercebridge	North East	Military	LR	20872	422

Table 5.2. List of main outliers with dog bones >400 NISP.

Large outliers above 400 NISP were found on 17 South and three North East site phases. All are very substantial, thoroughly excavated sites. Seven sites had significant numbers of ABGs that were chosen for primary analysis: Owslebury, Greyhound Yard, Oakridge, Danebury, Houghton Down and Balksbury Camp. It is noteworthy that no Central Belt or Eastern site features in this list. Although discussed more extensively in Chapter 4, it is also notable that both Iron Age and Roman sites/site phases are represented. Here, region appears to be the more important factor for high numbers of dog bones.

Kruskal-Wallis ANOVA and post-hoc testing (see 3.2.10) indicate that there is a significant regional difference in dog NISP, but only between a few regions, mainly the South, Central Belt and North (see Appendix B). Given that the datasets for the East and North East are comparatively small, it is possible that, with a larger dataset for these regions, significant differences may be present.

However, the key regional difference may simply be due to larger sites in the South that have more overall NISP. This possibility is apparent when comparing the total dog NISP. Despite the greater number of sites and site phases in the Central Belt, the South has nearly four times the number of bones.

5.1.2. Number of Identified Specimens: Percentage by Region

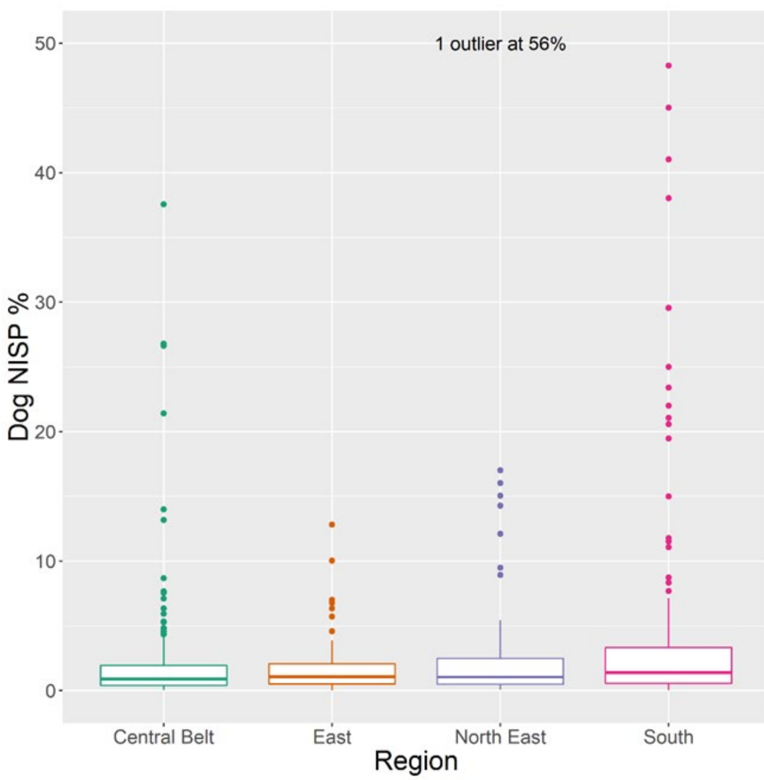

Fig. 5.2. Boxplot of dog NISP percentages.

To eliminate the possibility that regional differences may be due to larger sites in the South, I compared dogs as a percentage of total NISP for each site phase. This reveals similar patterns to NISP between the four main regions (see Fig. 5.2). While variation is smaller than in 5.1.1, South and North East sites still have a higher third quartile and 'whisker' than East and Central Belt sites. The only difference is that the median for the North East is closer to the latter two regions.

Region	Mean	SD	Median	IQR
Central Belt	1.99	3.96	0.90	1.53
East	1.92	2.37	1.07	1.55
North East	3.72	8.17	1.04	2.00
South	3.82	7.56	1.39	2.77

Table 5.3. Table of dog NISP mean, standard deviation, median and interquartile range.

The mean and standard deviation are useful only as a descriptive statistical method, given that the data is not normally distributed. Nonetheless, both show difference between the main four regions (Table 5.3). The mean for the Central Belt and East are much lower than the North East and South, as is the standard deviation.

5.1.3. Associated Bone Groups by Region

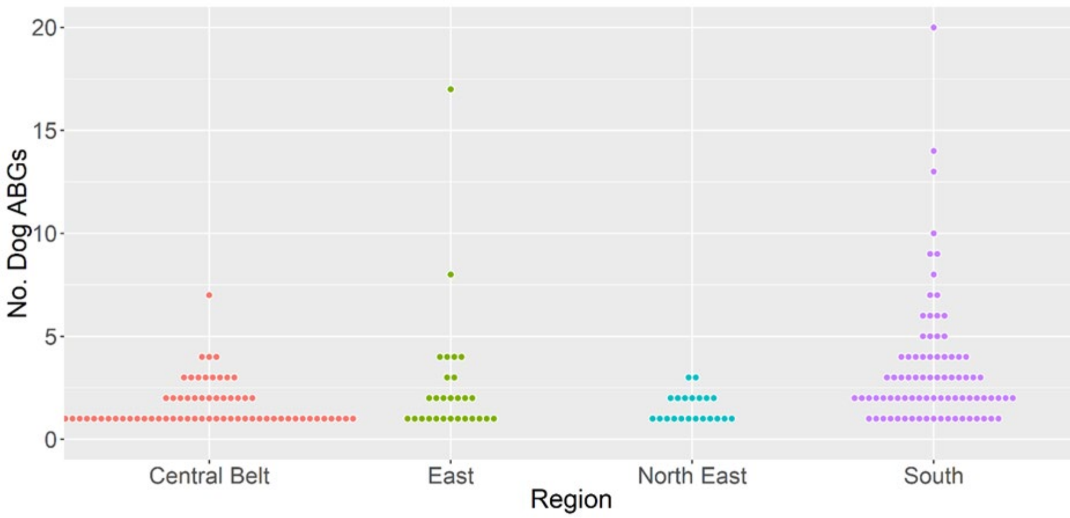

Fig. 5.3. Dotplot of dog ABG numbers per site phase, divided by region.

The regions have slight variation in their ABG patterns. Most Central Belt site phases, if they have dog ABGs at all, have only one; the overall shape is that of a bottom-heavy pyramid (Fig 5.3). By contrast, site phases in the East and South are more likely to have two or more ABGs and their distributions have a more vase-like shape as a result. These differences mirror the percentage of sites with ABGs. Only 18% of sites in the Central Belt have dog ABGs, in contrast with c.30% for the other regions (Table 5.4).

Region	No. Site Phases	% w/ABGs	Total ABGs	% w/Dog ABGs	Total Dog ABGs	Dog ABGs (as % Total)
Central Belt	366	34	387	18	110	28
East	96	35	108	29	74	69
North East	73	48	213	29	32	15
South	306	42	1910	30	722	38

Table 5.4. Table of key ABG data, divided by region.

Site Name	Region	Settlement Type	Phase	Dog ABGs	All ABGs	% of Total
Oakridge II/IV, Basingstoke	South	Rural Settlement	LR	134	360	37%
Owslebury	South	Rural Settlement	LR	74	125	59%
Oakridge II/IV, Basingstoke	South	Rural Settlement	LR	63	170	37%
Greyhound Yard	South	Urban	MR	43	51	84%
Oakridge II/IV, Basingstoke	South	Rural Settlement	ER	34	157	22%
Springhead, sanctuary complex	South	Religious	MR	34	45	76%
Winchester North	South	Urban	MR/LR	28	U	U
Balksbury Camp 95	South	Rural Settlement	MIA/LIA	24	50	48%
Greyhound Yard	South	Urban	ER	20	33	61%
Baldock	East	Urban	ER	17	18	94%
Owslebury	South	Rural Settlement	LIA/ER	14	38	37%
Greyhound Yard	South	Urban	ER	13	28	46%
Alcester, Explosion site	Central West	Defended Small Town	LR	13	19	68%
Greyhound Yard	South	Urban	LR	10	21	48%

Table 5.5. List of main outliers with >10 dog ABGs.

Outliers, with 10 or more dog ABGs, were found on 14 site phases (Table 5.5). These came from similar sites to the NISP outliers: Oakridge Well, Owslebury, Greyhound Yard, Balksbury Camp. But unlike the NISP outliers, none came from the North East. All were sites from the South, except for one each in the East and Central West. Half were from urban sites. When tested, the ABG difference was found to be significant between regions, with a very low p-value of 1.027e-08. But when post-hoc testing is applied, all of the significant values exist between the South and other regions (Appendix B).

5.1.4. Associated Bone Group: Percentages by Region

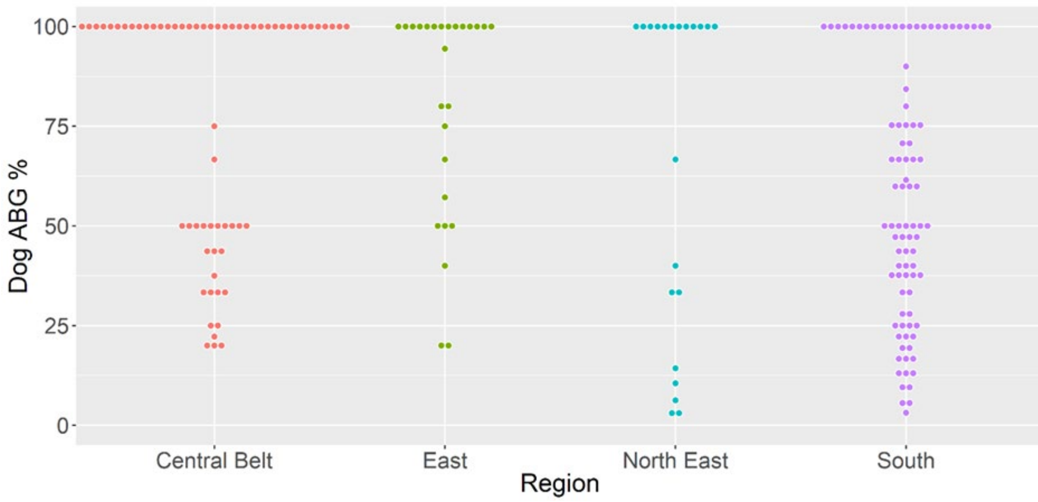

Fig. 5.4. Dotplot of dog %ABG (as proportion of all ABGs) per site phase, divided by region.

When ABG proportions are analysed in-depth, regions follow a similar pattern in Fig 5.4. Most sites with dog ABGs have only dog ABGs, and a smaller number have varying proportions of other animal ABGs. A very small difference between the Central Belt and South can be seen; despite similar numbers of site phases, the Central Belt has more site phases with dog ABGs exclusively. This variation may be due to the higher number of ABGs per site phase in the South overall, making mixed ABG assemblages more likely.

5.1.5. Section Summary and Findings

The main finding is the difference between the South and other regions. Yet the significant NISP and ABG differences in the South may be due mainly to larger sites with larger assemblages. However, this region also has slightly higher *proportions* of dog bones, and a higher median, as well as absolute numbers. For sites with high numbers of NISP or ABGs, most sites come from the South and generally have both high NISP and ABG. This is particularly pertinent for the largest Roman sites such as Owslebury, Oakridge Well and Greyhound Yard.

Between other regions, there are few or no significant differences in ABG and NISP numbers. Regional differences are still possible, but larger samples would be needed to investigate, particularly for the East and North East. The graphs in this section show, however, that any variation that may exist is likely small. There is a possible exception for ABGs overall: the East dataset has a much higher proportion of dog ABGs (as % of total ABGs) than the North East. The difference may be less with dogs, given the lack of statistical significance between them, but with the proportion of other animals that were selected for deposit as ABGs.

5.2. Regions Through Time

The limited regional differences noted thus far may not be purely down to local dog-keeping habits. They may be affected by other factors, such as phase. If, for instance, most eastern sites are from the later Roman period only, the regional data may reflect time more than space. To this end, it is necessary to explore both together.

5.2.1. Number of Identified Specimens by Phase and Region

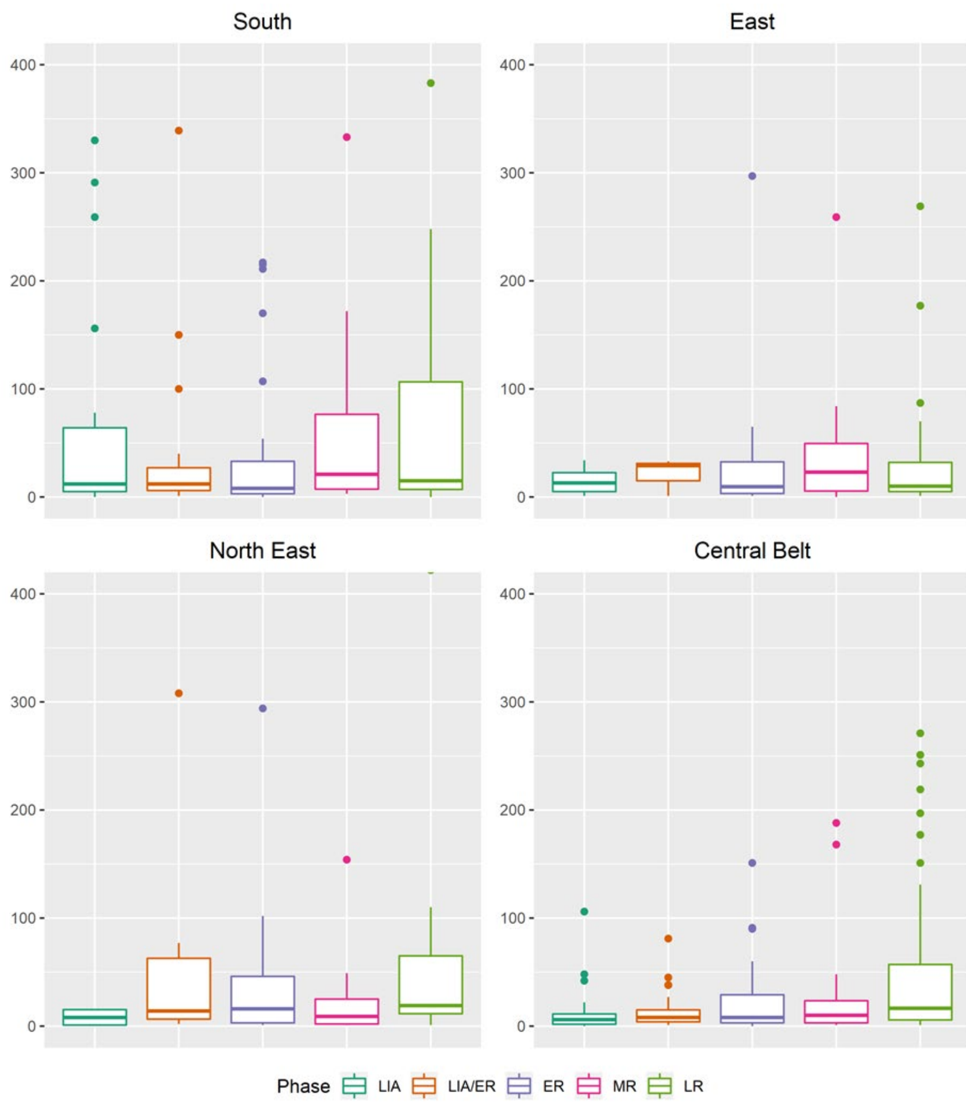

Fig. 5.5. Boxplots of dog NISP numbers by region and phase.

The Early and Middle Iron Age datasets are less helpful when studying change caused by the Romans, and have been excluded from the analysis in Figs. 5.5. and 5.6. The remaining phases vary in pattern between the main four regions. Median NISP rises and falls during different phases for most regions, with the exception of the Central Belt, where it only rises steadily. The range of values also differ: for instance, the upper and lower quartiles have a narrower range in the Late Iron Age for all regions but the South, where they are wider in range. Generally speaking, the site phases from the South have more variable ranges than the Central Belt, where the difference between the upper and lower quartiles is rather narrow, except in the Late Roman period.

Several outliers were missed by Fig. 5.5. Two site phases in the North East and ten in the South have dog NISP totals of over 400, seven were between 400-1000, four were between 1000-2500 and one huge phase from Owslebury contained over 4200 dog bones. That most of these came from the South is interesting, although it may be mainly due to the very large bone assemblages from this region (refer back to Table 5.2).

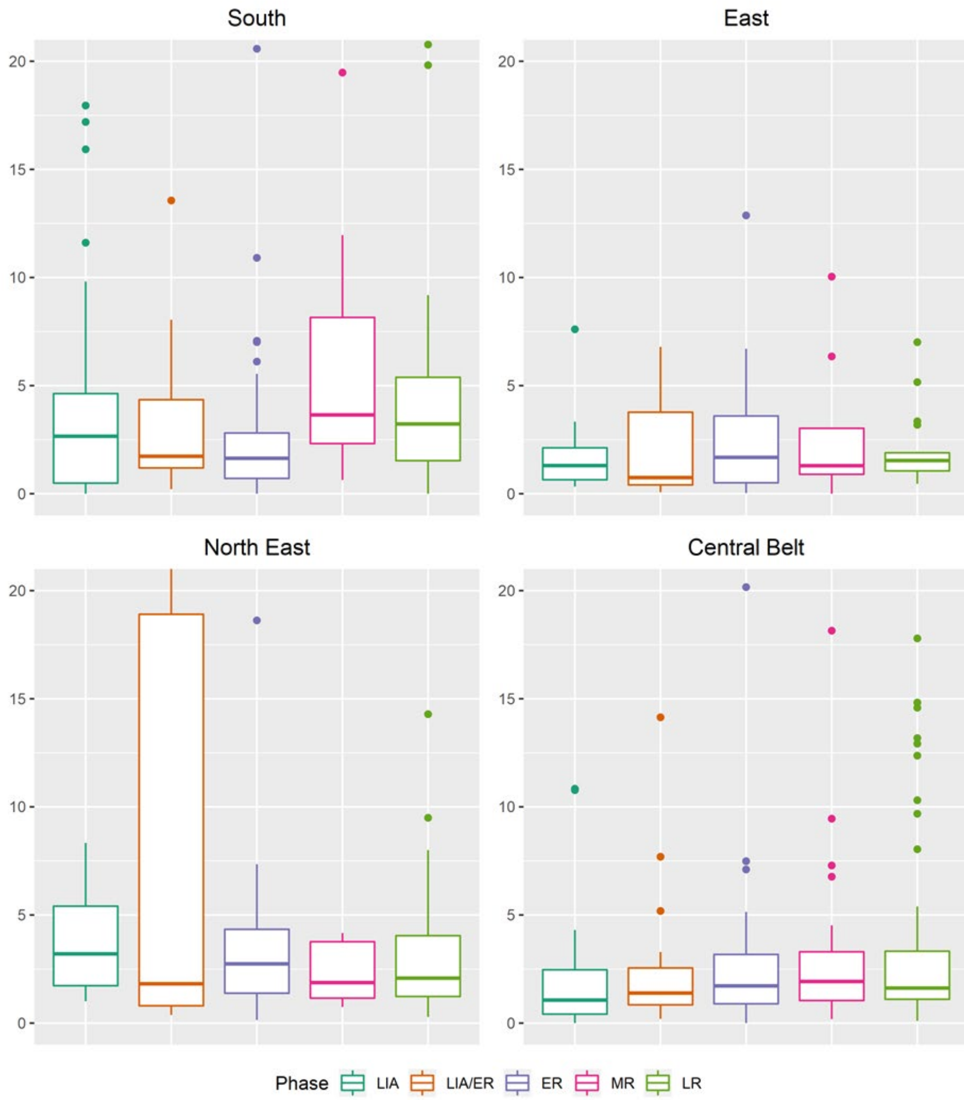

Fig. 5.6. Boxplots of dog %NISP numbers by region and phase.

However, as with the analysis in 5.1, NISP has its drawbacks: a given region and phase may simply contain more dog bones because the assemblages are larger. When %NISP is investigated instead, the patterns noticeably change. Dataset variability *increases* in each region, with wider ranging upper and lower quartiles for each phase. The overall trends in the East and Northeast change, with some phase medians dropping or rising relative to others. A few trends, however, remain similar. The median patterns in the South and Central Belt are still the same, with a drop during the Early Roman for the former, and gradual rise across time for the latter. Overall, there are still striking differences between the main regions.

Before drawing any conclusions, it is crucial to think about dataset size. As noted in 5.1, even the main regions have vastly different numbers of sites. When divided into phases, the numbers of site phases may be very small in some cases, making the results unreliable. In the East and North East regions, the number of site phases for the Late Iron Age-Middle Roman dataset ranges from 3-18, with many below 10. By contrast, the more populous Central Belt and South ranges from 26-72 (see Appendix B).

Thus, the patterns in the East and North East dataset may not accurately reflect dog trends in these regions. However, it is still noteworthy that the Late Roman phase, which is the most numerous in all regions, has local variations. The median, lower and upper percentiles for both NISP and %NISP are all higher in sites from the South, suggesting that the region has both more relative and absolute numbers of dogs than others.

Ultimately, regions may have varied from one another even when phase is accounted for. This variation is significant. But when broken down by region, the East and North East are statistically insignificant, perhaps in part due to their smaller datasets. Only the Central Belt has significant differences between phases (see Appendix B). Yet post-hoc testing reveals no significant difference between any region in the Central Belt. The results from the South are more interesting: the significant differences are mainly between the Middle Iron Age and several Roman phases, but not between Late Iron Age and Roman phases (see Appendix B). It is possible that the Roman invasion itself did not prompt much change in dog numbers, but small change noted instead happened gradually over the occupation. Sociopolitical developments throughout the later Roman Empire might have also played a part.

5.2.2. Associated Bone Groups by Phase and Region

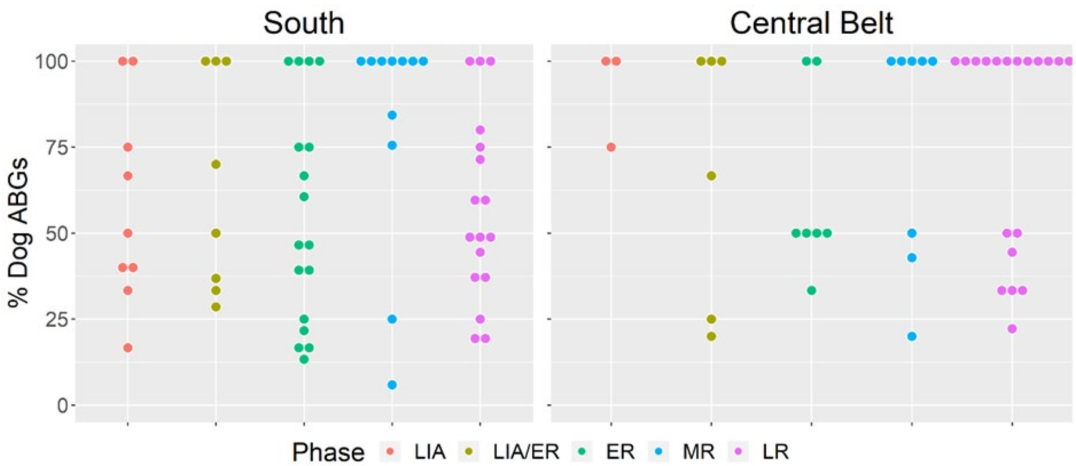

Fig. 5.7. Percentage of dog ABGs in site phases with at least one dog ABG.

In contrast to dog NISP, Fig. 5.7 shows that ABG proportions are much less variable between regions and time. Many site phases, if they have any dog ABGs at all, consist only of dog ABGs. If not, they make up between 10-80% total ABGs in fairly similar patterns between region and phase. For a couple of groups, such as the Central Belt in the Late Roman period, the trend is slightly different: most site phases have only dog ABGs, and those with mixed dog/other ABG datasets are the minority.

Region	LIA	LIA/ER	ER	MR	LR
Central Belt	21	31	62	90	93
East	2	2	41	8	26
North East	9	10	13	38	111
South	59	146	334	137	812

Table 5.6. Total number of ABGs by phase and region.

Yet, in absolute numbers, the trends are very different. Two main threads are apparent from Table 5.6, the first being that sites in the South have more ABGs than other regions but far more in the Late Roman period. This difference may be accounted for, in part, due to containing more sites than the East and North East. However, the Central Belt has more sites than the South yet less ABGs. The second is that ABG numbers are higher in the Roman period, particularly the Late Roman, than the Iron Age in all regions. I explored this more in Chapter 4, but the fact that it is a universal trend is particularly interesting. It is possible that dogs were more likely deposited or survived as ABGs wholescale in the Late Roman period. While a small change, this suggests that some people, spread across the whole province, may have modified part of their deposition practice.

Region	LIA	LIA/ER	ER	MR	LR
Central Belt	33	23	18	13	37
East	50	0	78	75	88
North East	44	70	46	13	7
South	31	23	31	69	40

Table 5.7. Dog ABGs (as percentage of total ABGs) by phase and region.

The proportion of ABGs that were dogs may be more significant than absolute numbers. Despite the huge number of ABGs in the Late Roman South, Table 5.7 reveals that only 40% are dogs. By contrast, dog proportions are much higher in the contemporary East, at 88%, and much lower in the North East at 7%. However, these differences may not be due to the region. Exceptionally large sites may influence the results; Oakridge Well has 530 ABGs from its Late Roman layers, and Wattle Syke has 72, a large proportion of the totals. Despite this, some general trends are visible. Every region drops in dog ABG proportions around the Late Iron Age/Early Roman or Early Roman period, and most rise in the Middle and/or Late Roman, with the exception of the North East. ABG proportions are overall higher in the East, and lower in the Central Belt. Conversely, the South and North East showing large fluctuations from phase to phase.

No significant difference can be found in the dog ABG data, neither overall nor within any region. As many sites have no ABGs at all, analysis is more tenuous than the NISP dataset, where all sites had at least 400 NISP. Ideally, a larger dataset would be needed to investigate further.

5.2.3. Section Summary

Dog numbers fluctuate through time across the main regions, but with small differences between them. A few common trends are visible: the Late Roman period is usually linked with a rise in dog bones across the board, both disarticulated and as ABGs. The small sample sizes of the East and North East mean that conclusions are less certain, but may have different patterns from the larger two regions.

5.3. Dogs, Settlements and Regions

Numbers of dog bones and skeletons recovered vary by settlement type, as Chapter 4 showed. While the most difference was found within the Iron Age and Roman periods, not between them, settlement types also developed differently across regions (Allen 2016: 139-140). Given the general differences between regions, dog keeping and deposition may have varied within different settlements.

5.3.1. Settlement Types and Number of Identified Specimens

Region	Hillfort	Military	Nucleated Settlement	Rural	Urban
Central Belt	5	5	28	223	42
East	2	7	6	41	22
North East	NA	5	9	33	9
South	22	0	22	165	68

Table 5.8. Number of site phases by region and settlement type.

My data contains five overarching settlement types: rural, urban, nucleated settlement, military and hillfort. The latter two are smaller datasets than the former and, as Table 5.8 shows, not evenly represented across regions. Hillforts are mostly in the South, and completely absent from the North East data. Military sites, by contrast, were not found in the South. For other settlements the differences are less dramatic; there are slightly less urban sites relative to rural in the Central Belt, while the South and East have a much higher number.

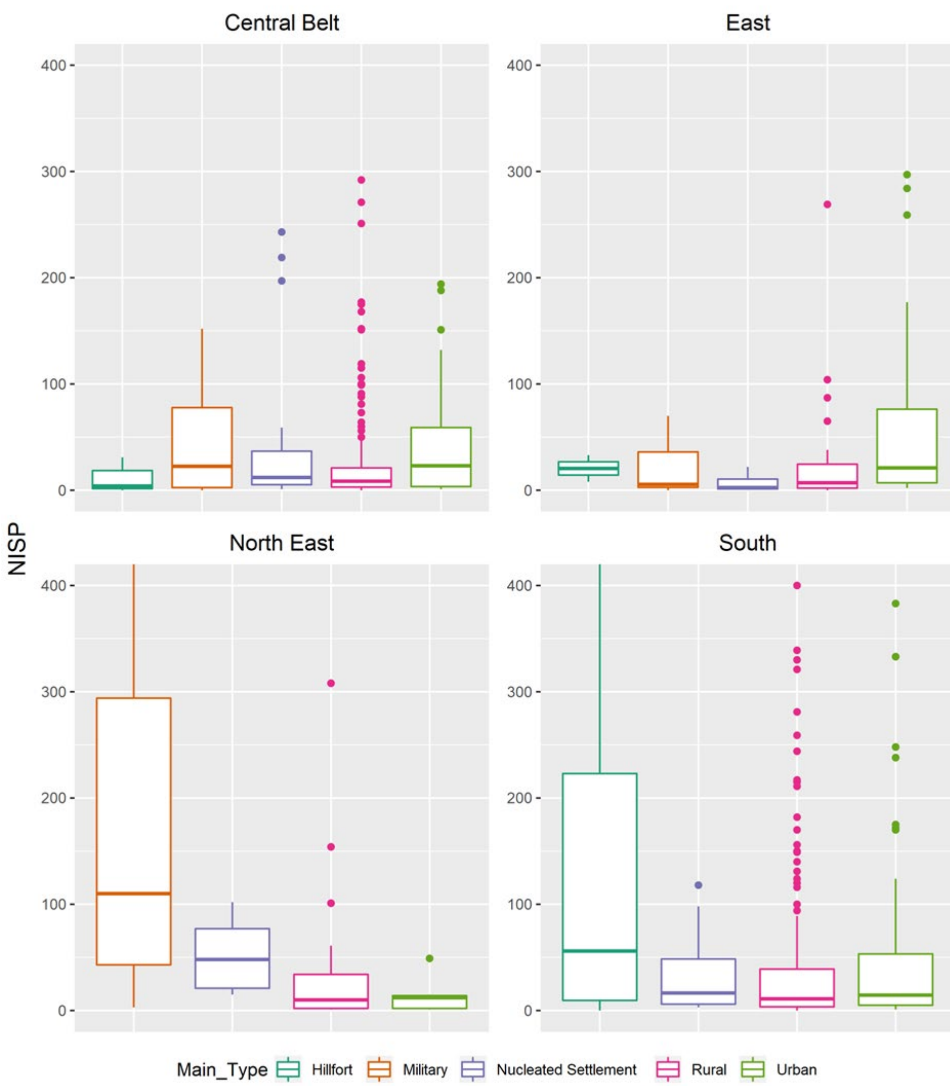

Fig. 5.8. Boxplots of dog NISP numbers by region and settlement type.

The range of NISP, shown in Fig. 5.8, has a few notable trends. The first, and most striking, is that urban sites have higher medians and upper quartiles than rural and nucleated settlements. The pattern applies to all regions except the North East, where urban sites are few. Nucleated sites have higher medians and upper quartiles than rural sites respectively, with, again, an exception in the East where they are fewest in number. No clear patterns can be seen for hillforts and military sites; both are highly variable from region to region. Hillforts have quartiles and medians that are fairly close together, indicating a narrow data range. The exception is the South, where the range is particularly broad. The upper quartile ends at around 220 NISP, a huge number relative to the rest of the data. Partly this result may be due to the small number of site phases, but it may also be due to the fact that most recorded hillforts were very large sites like Danebury and the Danebury Environs. This sampling issue may also be responsible for the vast data range of North East military sites, which is mainly drawn from large garrison settlements such as Piercebridge and York (see Appendix D).

Although settlement NISP patterns are fairly uniform across regions, a couple of differences may be seen. The upper percentiles and medians of sites in the South are, on average, higher than other regions: a difference that has persisted throughout the chapter. Other regions are mostly indistinguishable from one another, and do not have any clear overall differences that set them apart.

When %NISP is analysed instead, some results change (Appendix B). Of particular interest is the steep drop in upper percentile for the North East military sites. The largest site in the dataset, Piercebridge, has a total NISP of 20000 and dog NISP of 422, making dogs only 2% of the total despite their large overall number. This drop also occurs in hillforts in the South for the same reasons. Generally, rural sites have higher medians and quartiles relative to NISP values, and thus are a higher proportion of rural assemblages despite lower overall numbers. Not only did dogs have a higher NISP than other regions, they also made up a higher proportion of assemblages in the South.

While noticeable on a chart, these differences need to be tested for statistical significance. Using the methods from 3.2.10, an exceptionally low p-value of 0.00019 all but guarantees the results are not due to chance. When specific regions are tested, all but the Central Belt are significant (see Appendix B). Post-hoc testing shows that most significant results are between urban and nucleated or rural settlements. As Kruskal-Wallis ANOVA uses NISP, and not %NISP values, some of this difference may be due to overall NISP differences: If, for instance, urban sites have larger assemblages than rural, and dog proportions are the same for both, then NISP will be higher for urban sites. Given large sites like Danebury and Piercebridge, this trend is particularly applicable to hillforts and military sites. However, rural and urban sites still vary when %NISP is used. Thus, the significant differences between the two are likely from overall *and* proportional variance.

5.3.2. Settlement Types and Associated Bone Groups

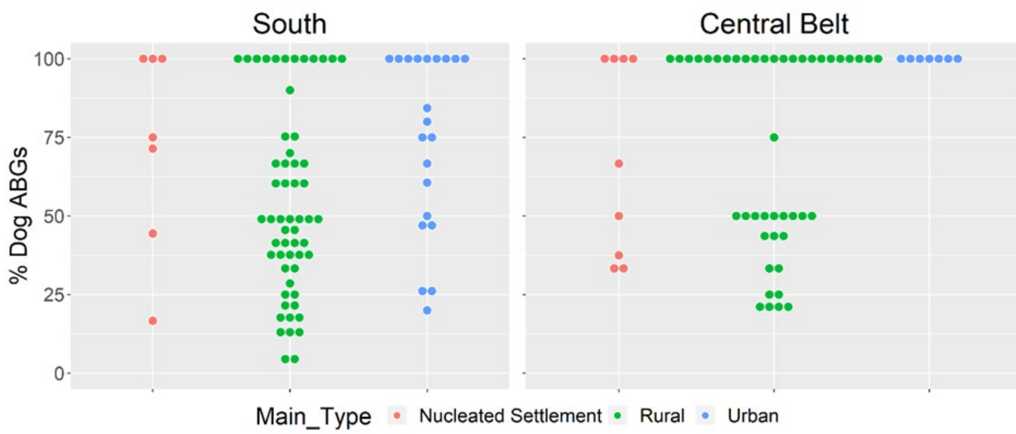

Fig. 5.9. Percentage of dog ABGs in site phases with at least one dog ABG. South and Central Belt regions and largest settlement types only.

Dog ABG percentages, shown in Fig. 5.9, follow a similar pattern to 5.2. Many sites have only dog ABGs, and those that do not have a fairly even distribution of dogs from 10-90% of total ABGs. The largest settlement type, rural sites, has a slight 'bump' in values at around 50%. Overall, no settlement type or region has a distinctly different pattern of dog ABGs.

Region	Hillfort	Military	Nucleated Settlement	Rural	Urban
Central Belt	75	289	1075	5200	1774
East	41	158	42	938	1513
North East	NA	872	460	3654	118
South	5901	0	721	17334	7391

Table 5.9. Total number of ABGs by settlement type and region.

Region	Hillfort	Military	Nucleated Settlement	Rural	Urban
Central Belt	21	100	45	23	68
East	0	100	100	61	72
North East	NA	100	7	21	11
South	10	0	53	35	65

Table 5.10. Dog ABGs (as percentage of total ABGs) by settlement type and region.

When examined with Tables. 5.9 and 5.10 these results are given more context. All regions, not just the Central Belt and South, have a high number of rural dog ABGs. Despite this, however, they form a small proportion of *total* ABGs. Even in the East, where dog ABGs are much more common than other animals, rural dogs form less of the total than on nucleated or urban sites. Although the latter two are smaller in ABG total than rural sites, these settlements actually form a higher proportion of total ABGs in all regions except for the North East.

The regional differences noted from 5.2 appear once more. ABG proportions are very low in the North East, but high across all settlement types in the East. Southern sites have many more total ABGs, and make a higher proportion of the three main site types than the Central Belt, in spite of a higher number of site phases in Central England.

Smaller settlement types have too few ABGs to comment on regional trends. If the dataset for military sites were larger, the fact that all ABGs found on them were dogs may be of particular significance. Both the number and proportion of ABGs on hillforts is low, but this is an unreliable result: precise ABG numbers were unobtainable for much of the Danebury excavations from 1979-88. A more comprehensive analysis of the ABGs was proposed in Volume 5 (Grant and Serjeantson 1991: 482), but was ultimately never published in Volume 6. Only select ABGs were noted instead. However, the main publication suggests the numbers found were very high (Grant 1991 and Serjeantson: 482).

Overall, the results are statistically significant but there are no significant differences by region (see Appendix B). As with 5.2, a high number of zero values may prove a hindrance to testing and potentially increase the risk of Type II error (a 'false negative' finding). Thus, while the final verdict as to where specifically regions and site types differed is not possible, the testing suggests that an obvious or great contrast within regions is not present.

Region	Hillfort	Military	Nucleated Settlement	Rural	Urban
Central Belt	25	72	72	71	118
East	Inf	158	21	35	34
North East	NA	291	77	183	39
South	590	0	38	33	45

Table 5.11. Number of dog NISP per ABG.

NISP and ABG numbers, on initial examination, correlate with one another; the more NISP, the more ABGs. This especially holds for the South. Yet it is worth comparing them directly to see if there are any differences between regions and site types. The results are worth discussing: urban sites have more (or nearly the same) NISP per ABG than rural and nucleated settlements except for the North East, where all previous trends are changed (Table 5.11). Despite the low number of ABGs, this region also has a high ratio of NISP to ABG. In the Central Belt and South, rural sites have the lowest number of dog bones for each ABG. Hillforts and military sites, as with the rest of this section, are much more variable due to their small sample sizes.

5.3.3. Smaller Sites in Detail

As previously discussed, urban sites had a broader data range and median than other settlements. This category was a composite of two smaller site types: larger urban sites and the Defended Small Towns (DST) data from the RRSP. Most (80%) of the data come from the former, and only 28 DST site phases have dog bones, making inter-regional comparison between the two impossible.

Because of the huge NISP and %NISP fluctuations, the charts in 5.3.1 do not fully explore hillfort and military sites. These are also settlement types that, unlike rural and urban settlements, may be more common in the smaller, or 'minor' regions.

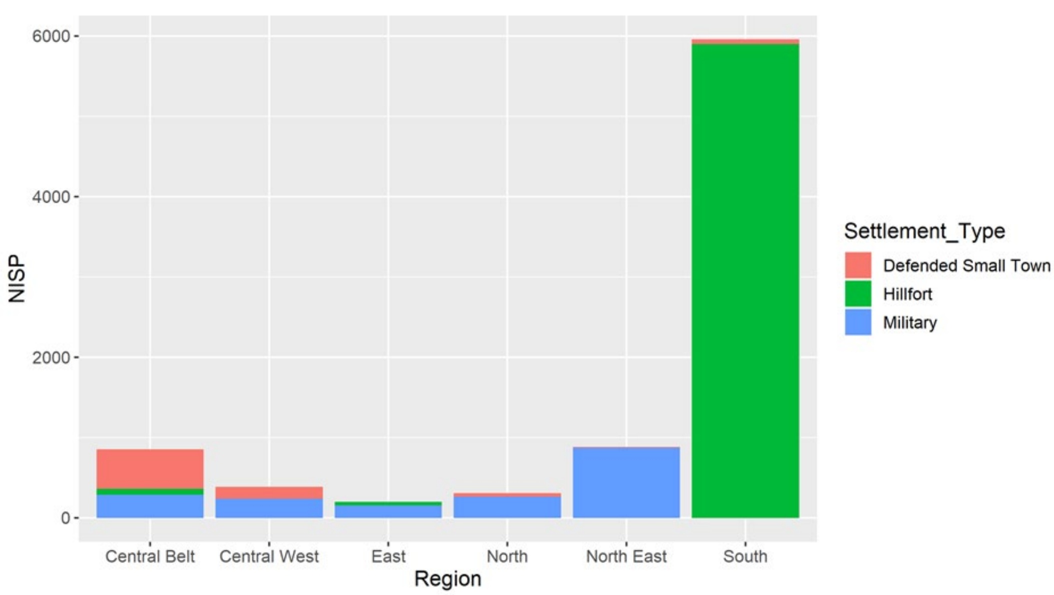

Fig. 5.10. Dog NISP counts by smaller settlement type in all regions. No results for South West.

Region	Defended Small Town	Hillfort	Military
Central Belt	20	7	8
Central West	8	NA	9
East	NA	3	8
North	2	NA	24
North East	2	NA	5
South	5	24	NA

Table 5.12. Number of site phases per smaller settlement type in all regions. No results for South West.

Fig. 5.10 and Table 5.12 reveal that, unlike the larger site types, many smaller settlements are common outside of the 'main' four regions. Military sites are particularly common in the North and defended small towns more numerous in the central regions of England. By contrast, hillforts are absent from most regions and far more common in the South. Defended small towns and military sites reflect Roman trends and hillforts pre-Roman patterns, so are not directly comparable, but are useful for showing trends in their respective periods.

%NISP also varied little from the NISP chart, with a slight increase in relative dog % for defended small towns as the only evident change. Despite variation in site size, military sites may have also regional differences in the number of dog bones relative to other animals. More data is needed to confirm or support this possibility, as the sample size is too small to test for statistical significance. Sample sizes are far too small for comment on ABG numbers. For instance, one DST site, Alcester, has 13 dog ABGs and single-handedly skews the ABG numbers for the Central West (Appendix B).

5.3.4. Other Settlement Features

As discussed in 4.2.3, the RRSP noted other attributes about sites in its database. Some of these may help indicate where and why dogs were kept, including: settlement size, form and presence of villa buildings. Preliminary testing indicated that settlement form had no significant inter-regional differences and a high p-value of 0.27 (Appendix B), so I will focus on settlement size and the presence of villa buildings.

Dog NISP and settlement sizes follow no consistent pattern (Appendix B). Results appear to have more correlation with sample size than settlement size or region, at least in the East and North East. Yet even in the two regions with large overall datasets, variation between small, medium and large sites changes according to the region. In the South, large sites have a higher median than medium sites but lower than small sites. In the Central Belt, the reverse is true, with medium sites having the highest median and large sites the smallest. Either regions have large differences in terms of dog numbers and settlement size, or the results are random and due to chance. Statistical testing indicates significant difference *between* regions, yet only the Central Belt has significant difference within a region. Post-hoc testing (Appendix B) shows that the only significant difference in the Central Belt is between medium and small sites, perhaps due to the small sample size for large sites.

Villa buildings are absent from the East dataset, and only nine site phases have villa buildings in the North East. Results are inconsistent in the other regions. Villa sites have a marginally higher median and quartiles in the Central Belt, and a moderately lower median and quartiles in the South, than non-villa sites (Appendix B). These variations, however, are not statistically significant.

Settlement Size, Villa Buildings and Associated Bone Groups

Region	Large	Medium	Small	Villas	No Villas
Central Belt	16	50	134	52	175
East	14	9	19	NA	44
North East	7	17	24	9	52
South	35	42	58	34	107

Table 5.13. Number of site phases by region and settlement size.

Dog ABGs and settlement size correlate with the sample size in Table 5.13, and each region has more total ABGs on small sites than medium and large respectively. However, exceptions between medium and large ABGs may be seen. Despite the Central Belt having more medium site phases than large, there are only 8 medium site ABGs and 11 large (Table 5.14). When ABG proportions are analysed instead (Table 5.15), larger sites have a higher proportion dog ABGs (as a percentage of total ABGs) than medium, and medium a higher proportion than small for the two largest regions. Statistically, this is not significant between regions. Within each region, only the Central Belt has significant variation (see Appendix B). ABG proportions for villa buildings follow a similar pattern to %NISP. The Central Belt has a higher % of dog ABGs on villa sites and the reverse is true in the South, but the difference is not significant.

Region	Large	Medium	Small	Villas	No Villas
Central Belt	11	8	40	24	36
East	4	3	12	NA	20
North East	7	6	9	3	25
South	70	108	263	11	432

Table 5.14. Total number of dog ABGs by settlement size and region.

Region	Large	Medium	Small	Villas	No Villas
Central Belt	52	30	21	29	17
East	29	100	50	NA	47
North East	7	27	13	19	13
South	51	47	30	26	36

Table 5.15. Dog ABGs (as percentage of total ABGs) by settlement size and region.

5.3.5. Section Summary

Disentangling regional difference from settlements has been challenging, particularly given the small sample sizes for military, hillfort and nucleated settlements. However, settlements have a few tendencies that apply for all or most regions. Urban sites generally have more dog NISP and ABGs than rural and nucleated sites, but the discrepancy is small. Hillforts, nucleated and rural settlements all vary from one another in some regions.

The regional trends observed in sections 5.1 and 5.2 continued through this section. Southern sites have more NISP and ABGs, with a higher average proportion of dog bones and deposits than other regions. As with the earlier parts of the chapter, the larger regions, the South and Central Belt, have a number of significant differences between them. North Eastern and Eastern trends are harder to pin down, as they have small sample sizes. Regional change between the smaller site types may exist, particularly between military sites in the North and North East, but a larger sample size is needed to confirm or refute the possibility.

Ultimately, settlement types and features seem to be linked to dog numbers, but not universally. Regions matter too, and can change how settlement types correlate with dog bones and skeletons, or if they are linked at all; for instance, the patterns seen in the Central Belt and South for villa buildings, one region having more NISP and ABGs on villa sites, and the other with higher numbers for non-villa sites. Interpreting the fact that some factors are significant in some regions but not others, e.g. urban sites and settlement size in the Central Belt compared to less difference elsewhere, will be difficult. It may be that settlement types developed differently by region, e.g. the abundance of urban sites in the South compared to few in the North East. This may have had a slight influence on dog numbers but not huge, given their ubiquity. How these dogs were treated after death may have been more prone to regional influence.

5.5. The Wider Picture

	Key Results
5.1: Overall Regional Differences	The South has significantly higher NISP, %NISP and number of ABGs overall than other regions. Little variation between other regions. The exception is dog ABG proportions: the East has a particularly high proportion of dog ABGs (as % of all ABGs recovered) and the North East a particularly low proportion.
5.2: Regional Differences by Phase	Greatest NISP/ABG variation is through time, not between regions. The Late Roman period in particular has a rise in dog NISP and ABGs across Britain. Despite this, however, it is possible that the East and North-East had local patterns of dog keeping/deposition through time. The former has a high proportion of dog ABGs through time, even pre-Conquest. The latter has a drop in dog ABG proportions through time. Both results need a larger dataset to ascertain.
5.3: Settlement Type	NISP varies between urban and rural sites. Difference is significant, with urban sites containing slightly more dog bones (by absolute and proportional numbers) than rural on most regions. Potential trend for military sites to deposit less ABGs overall, but nearly all deposited were dogs. However, needs larger dataset to ascertain.
5.3: Settlement Size and Villa Buildings	General lack of pattern between regions, with dog NISP/%NISP numbers varying widely between settlement sizes. However, these differences may be significant *within* regions, at least in the Central Belt. Generally the larger the site, the higher proportion of dog ABGs. However, this result is not statistically significant and does not apply in the smaller regions (East and North East). Thus, dog keeping/deposition may vary between small, medium and large sites according to region, but needs more work to determine precise differences. No clear pattern and lack of significance when comparing sites with villas against those that have none.

Table 5.16. Summary table of key regional results.

Of the four largest regions, the South had the most distinctive patterns: dogs appeared to be more numerous (see summary Table 5.16). While this trend was mainly due to the larger assemblages found overall, a slightly higher number of dogs were noted even when proportions were taken into account instead. This trend was noted not only for overall numbers of bones, but also the number of ABGs. This difference contrasted particularly with the Central Belt, which generally had less dog bones and ABGs, despite the fact it had a dataset equally large.

Smaller regional trends may exist. The East and North East have slight distinctions from the other regions: the former has a higher proportion of dog ABGs, and the latter less, but generally higher NISP numbers. Even the largest sites in the North East, with high numbers of dog NISP, have comparatively few ABGs. However, these datasets were also the smallest, with only 96 and 73 site phases respectively. Even fewer of these sites had ABGs to compare. More data is needed to explore these differences, and confirm if they fully represent the regions.

Comparing regional change through time yields underwhelming results. There is no indication that any one region developed much differently through time compared to the others; most regions appeared to increase in numbers at a similar time to others, particularly the Late Roman period. It is possible that minor differences existed, as testing indicated significant differences between the South and Central Belt, but these could not be narrowed down.

Settlement types, at least in terms of dog numbers, did not appear to have distinct regional characters. Urban sites have slightly more dogs, both NISP and ABGs, than other settlement types. While patterns in the other site types had slight differences between regions, very little could be found to be statistically significant; sample sizes were small for hillforts, military sites and nucleated settlements. Other significant characteristics, such as settlement size and the presence of villa buildings, seemed to have even less impact. Indeed, the distribution of dog numbers in different settlement sizes appeared nearly random, with no statistical significance. Dogs were ubiquitous. After reviewing dog numbers through both time and space, I will move on to the next major theme of the project: health. This will require me to 'zoom' in on the ABGs discussed in Chapter 4, and investigate them much more closely.

Chapter 6: In Sickness and in Health

One of the most under-studied archaeologically, but important aspects of a dog's life is its health. It is easy to measure a dog and say how big or small it was, or evaluate its burial context, but one of the most direct insights into past human-canine relationships is health. A dog's health affects its physical welfare and wellbeing, its day-to-day activities and role/s, how long it may live and, most importantly, human responses to it. Up until now, most studies of dog health and disease have been confined to a single bone (or collection of disarticulated bones) and sometimes an individual skeleton (e.g. Baxter 2006; Colominas 2015; Harcourt 1974; MacKinnon and Belanger 2006). While both can provide valuable insights, the former is not helpful for understanding the full life of a dog. The latter cannot further understanding of *population* health.

In this chapter I demonstrate the value of studying canine health at the level of a regional population. The major story to emerge is of Iron Age and Roman dog groups, mainly based on the individual ABGs I recorded (refer back to 3.1.1 for the basic summary). I will widen its focus as I move through the data: from a brief summary of the surviving body parts, to a comparison of skeletal pathology, and finally a consideration of patterns in health. To link the chapter to the themes of space and time, some of the analysis will be broken down by phase and region.

6.1. From Head to Tail: A Recap

Before looking at the pathology that the ABGs show, it is worth revisiting their skeletons and how complete they were, as loss of bones affects the lesions that may be found. As I discussed previously, the attrition is great. All dogs had at least 50% of their bones missing, and nearly half lost 90% between deposition and recovery. Body parts that had good recovery are the head, trunk and long bones, while the paw and joint bones were found less often, likely due to their smaller size and/or more fragile nature.

A specific element that was often damaged or missing is the skull: 54% of ABGs have it survive in some form, but only 12% have very good survival (Stages 4-5). While the mandibles themselves were commonly found, many teeth were lost, with a third of ABGs possessing none at all and another third with less than 10. The canines and incisors were lost the most frequently. Fortunately, the long bones survived well and evenly aside from the epiphyses and fibula, the latter being a fragile bone (see Chapter 4.3 for further discussion).

Some overall differences between Iron Age and Roman specimens were revealed. Iron Age dogs had better general recovery of bones, but particularly for smaller, more fragile paw and joint bones. These ABGs also had (better-preserved skulls). Roman ABGs may, therefore, be relatively under-represented in terms of skull, paw and joint pathology. However, the ABG population may suffer from under-recording of pathology: lesions may be present on the lost bones. Long bone and trunk pathology are likely to be least affected, given their good survival. Dental pathology is particularly likely to be under-represented, particularly for conditions that manifested close to death, leaving inadequate time for alveolus healing, canines and incisors. Another consideration is how survival affect specific types of pathology. As long bone epiphyses survived slightly less often than the shaft, lesions that affect articular surfaces may have minor under-representation.

6.2. How Health Varied

Now that the state of the ABGs has been recapped, we can move on to studying their pathology (or lack thereof). Throughout this section, continual reference will be made back to 4.3 and how the ABG survival may have influenced the results. I will also refer to individual dogs where applicable using their ID codes: e.g. CA-2 (Caistor 2). These may be used to find additional information in Appendices A, C and E.

6.2.1. Pathology by Location

Breaking down pathology by anatomical location can be done in two different ways: by a general category (such as trunk or limbs), or by specific element. Broad location is excellent for considering the general areas in which animals are affected by pathology, but may mask taphonomic issues that may skew their incidence. Specific elements, on the other hand, avoid these issues but can produce data that are hard to link together. To maximise useful data, I will analyse pathology both by location and *some* specific elements. The latter will consist of elements that are well-represented overall and have higher frequencies of pathology, such as the mandible, some long bones, vertebrae and ribs.

General Location

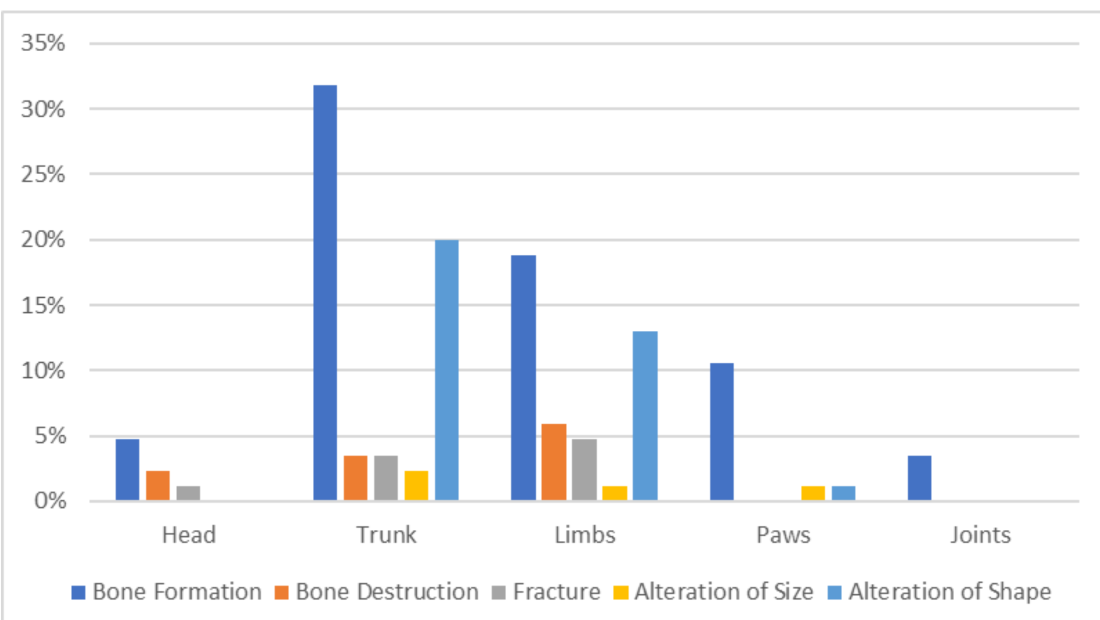

Fig. 6.1. Percentage of ABGs with lesions by anatomical area (see 3.2.5).

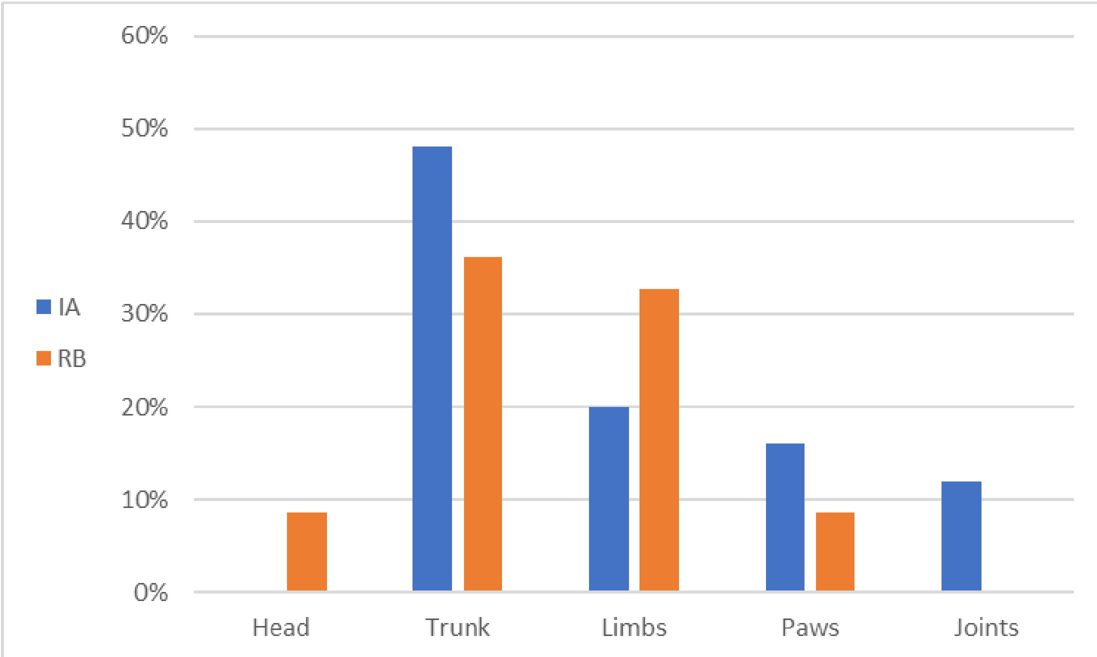

Fig. 6.2. Percentage of ABGs with lesions by anatomical area (divided into phases).

Absolute lesion numbers do not represent how common they are in dogs; some conditions may produce multiple lesions on a single animal. Therefore, percentages of ABGs affected by a lesion type or area will be used. I will quantify these results later in the section to account for differing preservation of areas, particularly between phases.

Trunk and limb pathology are most common, with bone formation and alteration of shape as the most frequent type found: a third of ABGs are affected by trunk bone formation (Figs 6.1 and 6.2). Relative frequencies of paw and joint pathology are low; this is likely due to taphonomy and the difficulty of identifying minute lesions in small bones. The rates of head pathology are low and do not include dental pathology. Again, this is likely due to taphonomy; a high rate of fragmented skulls makes pathology harder to identify.

When the dataset is divided into Iron Age and Roman groups, differences in lesion prevalence are significant ($p = 0.037$). Trunk pathology is more common in the former, as is paw and joint pathology. This may be due to better preservation since more paw and joint bones survived in Iron Age ABGs, as did smaller elements as a whole (see 4.3.1). Conversely, Roman dogs have over 50% more limb pathology and this is the only phase to have head pathology.

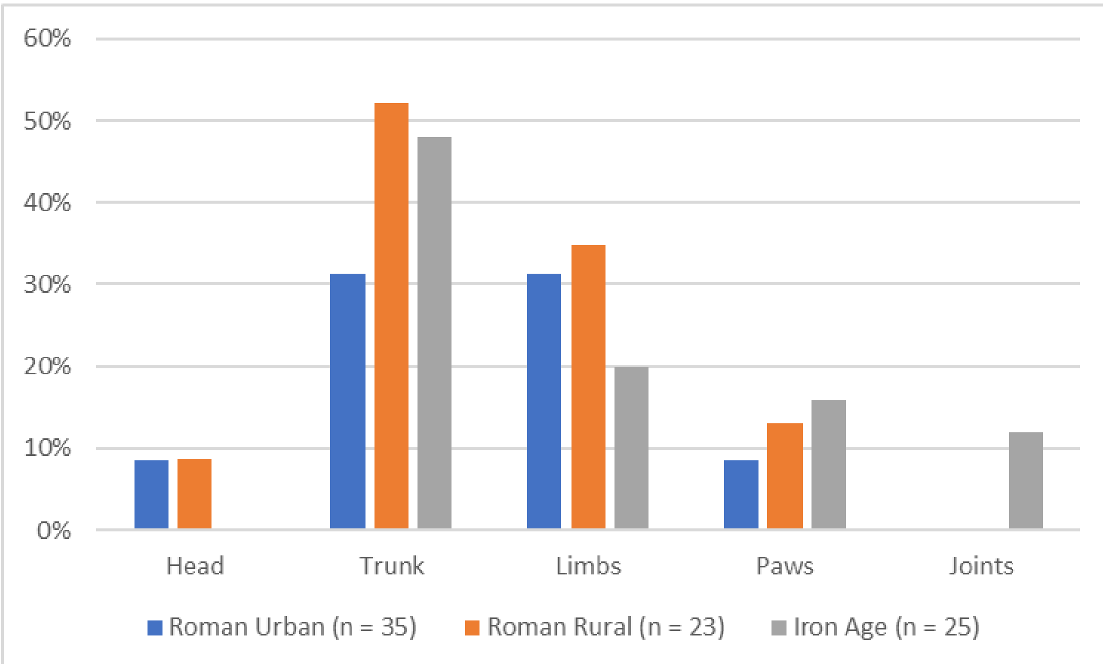

Fig. 6.3. Percentage of ABGs with lesions by general location and site type.

35 of the Roman ABGs originate from urban locations that are worth exploring separately. Fig. 6.3 shows that there are substantial differences between Roman urban and rural sites: trunk pathology is much higher on rural sites and paw pathology is also slightly higher. The frequency of head and limb pathology is similar at both site types. Although it would be particularly interesting to compare Iron Age hillforts against other rural sites, the dataset is too small. Therefore, Iron Age ABGs as a whole were compared against Roman rural and urban ABGs. They produce interesting results: Iron Age trunk and paw pathology is closest to Roman rural sites and limb pathology is noticeably lower than *both* Roman categories.

However, it must be recognised that most of the Roman data comes from two single sites: Greyhound Yard (21 urban ABGs) and Owslebury (18 rural ABGs) respectively. These data may not be representative of other urban and rural sites in Roman Britain. To address this issue, the ABG data was combined with other published ABG data from dogs in Roman Britain (cf. Bellis 2018). These data come from secondary reports of 27 urban and 21 rural ABGs from other Roman sites. Slightly different data categories were used in this project, so they have been standardised for compatibility, with one exception: paws and joints have been combined into one category.

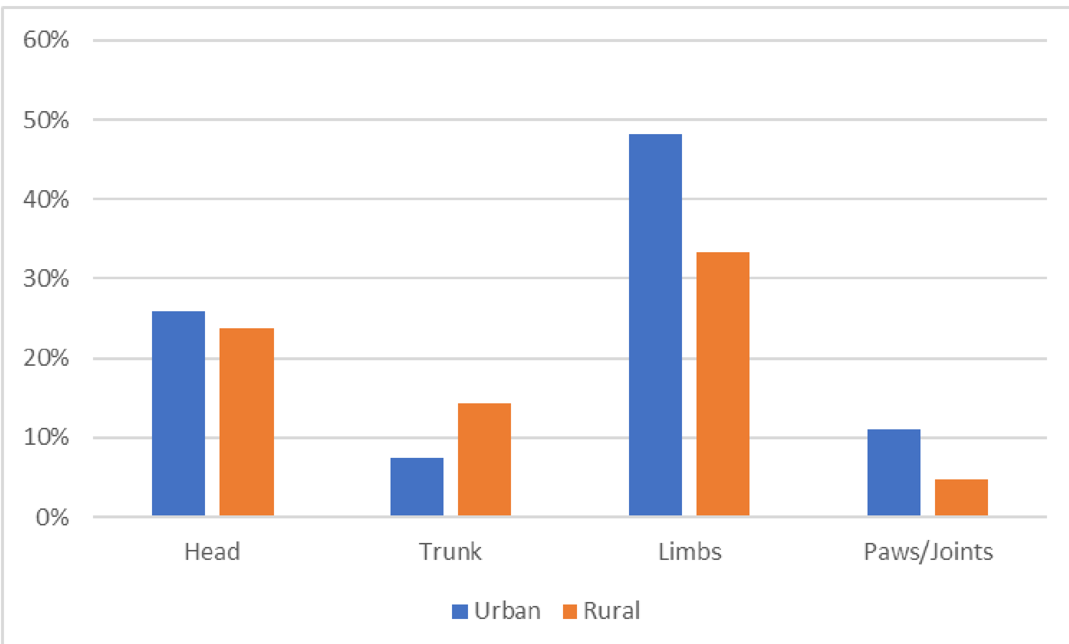

Fig. 6.4. Percentage of secondary ABG data with lesions by refined categories and site type (from Bellis 2018).

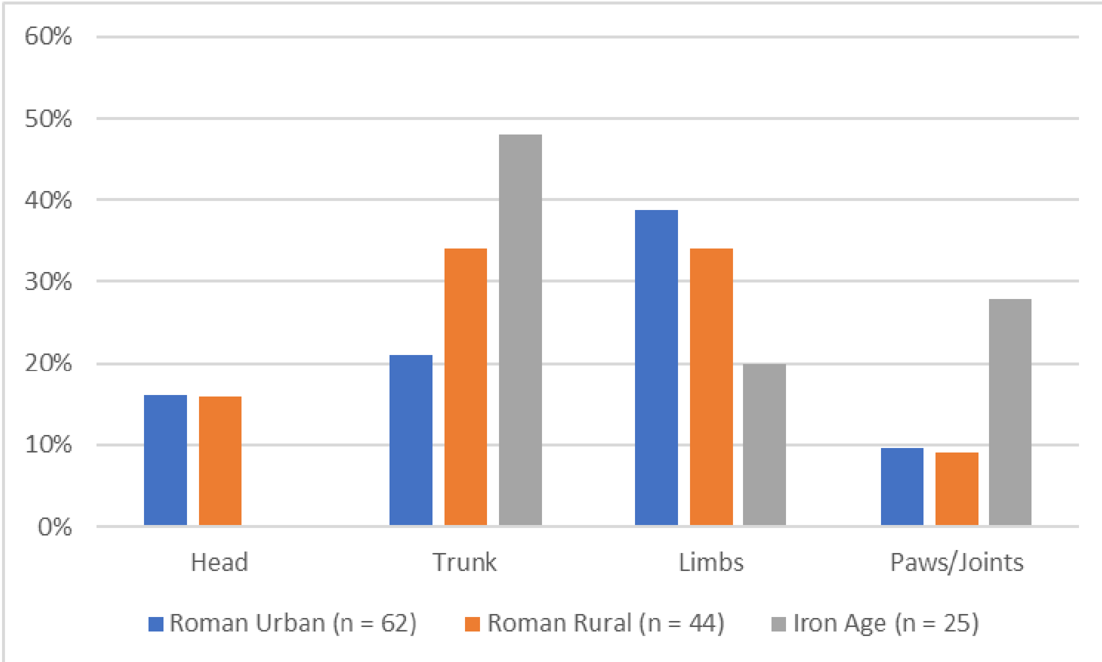

Fig. 6.5. Percentage of combined ABGs with lesions by general location and site type (from Bellis 2018).

The data from Bellis (2018) in Fig. 6.4 show that the pattern of trunk and head pathology are similar, while urban sites have a higher frequency of limb and paw/joint pathology than rural. When the two datasets are combined (see Fig. 6.5), the results do not change greatly. While percentages of trunk pathology decrease, the general pattern remains the same: urban sites have a lower percentage than rural, which is closer to the Iron Age dataset. Urban limb pathology is now slightly higher in incidence than the rural sites, but not by much; both Roman sites are still much higher in percentage than the Iron Age. The decrease in Roman paw and joint pathology may be due to differences in preservation in the secondary data and/or less attention paid to them by analysts. Overall, combining the two dataset brings out three key points for urban and rural sites across Roman Britain:

- Head pathology does not differ between the two site types.
- Trunk pathology is always lower on urban sites than rural: the latter is closer to the Iron Age in percentage.

- Limb pathology varies slightly from dataset to dataset, but in general, percentages are fairly similar between the two site types. They are always higher than the average Iron Age percentage.

Adjusting Pathology by ABG Completeness

The frequency of pathology by anatomical location is affected by how well each area survives. For instance, if the percentage of ABGs affected by trunk pathology is the same as the limbs, but the survival of the trunk is lower than the limbs in these ABGs, the trunk pathology may be under-represented. Its true prevalence, if it were to survive as well as the limbs, may be higher. The relative proportions need adjusting to account for this. However, it is not possible to adjust the percentage of ABGs directly. This is a measure of how many ABGs were affected by at least one lesion in a given area: while each needs only one lesion to count, it may have many lesions in that area. Thus, adjusting the proportions of limb pathology may not change the percentage of ABGs affected in a linear pattern. Some may already have limb pathology, but actually have had more lesions on bones that did not survive.

Another method can be used to adjust the Iron Age and Roman specimens, given that the rate of survival (per area) differed greatly between the two phases. A relative measure of pathology may be produced by dividing the number of lesions by the average percentage of survival for an area, and then dividing this by the total number of ABGs per phase. The formula is as follows:

$$X = \frac{\text{T. lesions / average survival \%}}{\text{T. Phase ABGs}}$$

This may then be compared between body parts. For instance, there are 94 Roman limb lesions. The average survival of this area is 34%, so assuming the lesion prevalence was similar on the missing bones, the total number of lesions may be 273 if all were to survive. Divided by 58, the total number of Roman ABGs, this produces an average of 4.7 lesions per ABG. By contrast, the Iron Age ABGs have a higher rate of survival at 48%, but only 6 lesions on the limbs. When adjusted, this is 13 lesions and an average of only 0.5 lesions per ABG. While it is uncertain that the proportion of lesions on missing bones are the same as surviving bones, it allows for more accurate comparison between phases.

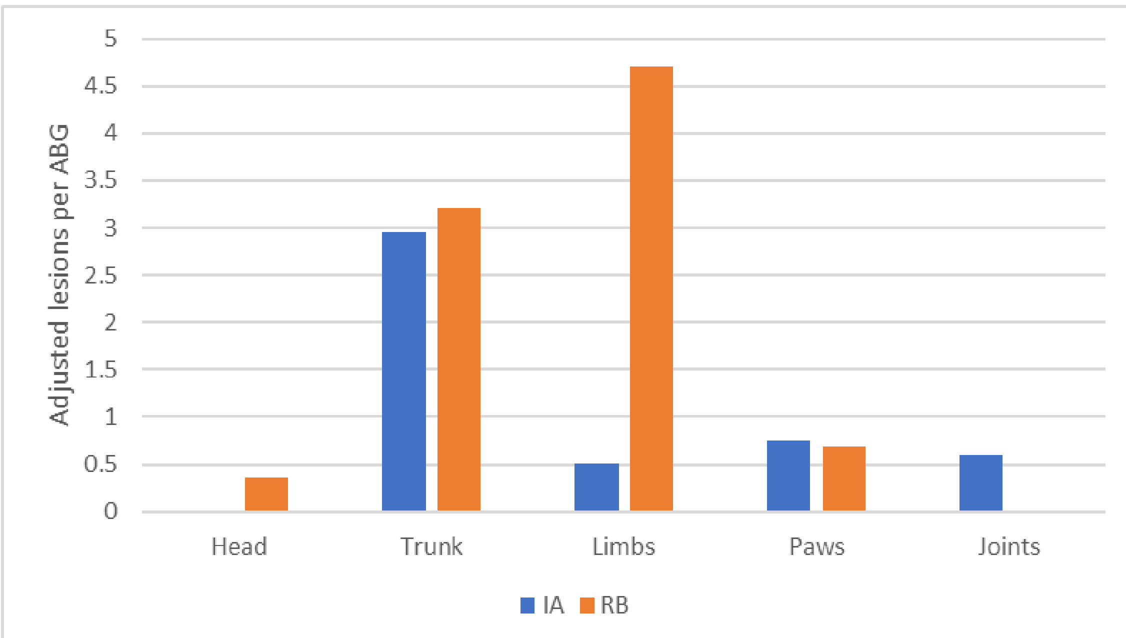

Fig. 6.6. Average number of lesions per ABGs, when adjusted against completeness. Compared by phase.

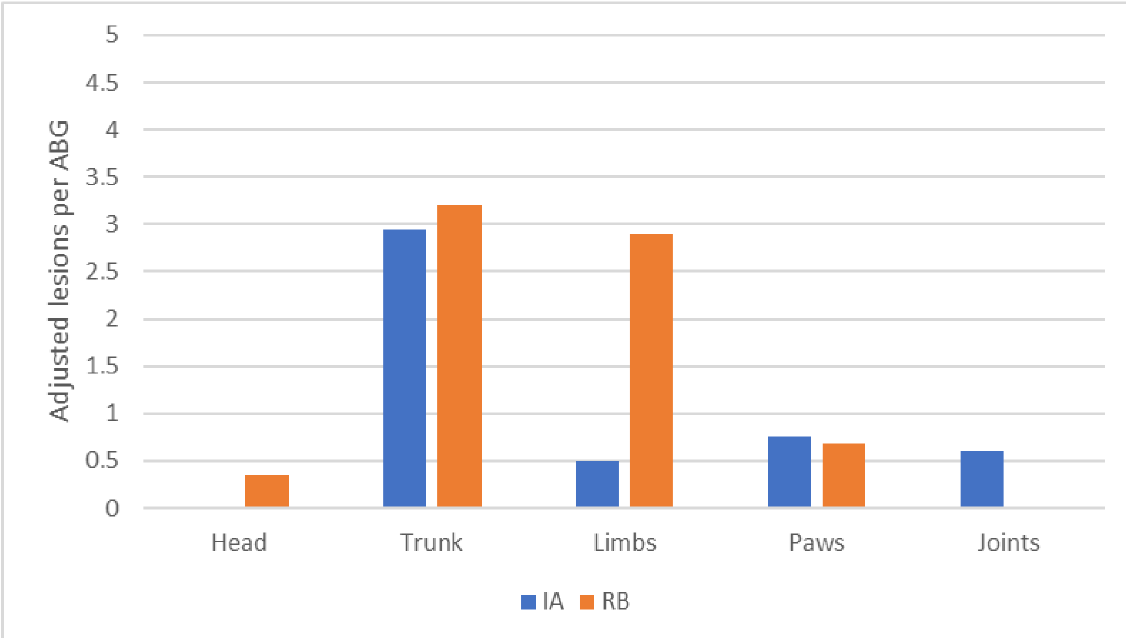

Fig. 6.7. Average number of lesions per ABGs minus limb bowing, when adjusted against completeness. Compared by phase.

Fig. 6.6 shows that, when relative proportions are adjusted, the results are somewhat different to the standard ABG % charts. It confirms that paw pathology variation in Iron Age and Roman specimens is due to differential survival, and shows that trunk pathology is in fact broadly similar between the two phases. Skull and joint pathology differ, but not by much. However, limb pathology is dramatically different: the amount of Iron Age limb pathology is slight, relative to the Roman. Most of this is likely due to the high number of lesions from Roman dogs with bowed limbs. Yet once these conditions are removed, it is clear that rates of limb pathology are still far higher (Fig. 6.7). Sections 6.2.2 amd 6.2.3 will look at the makeup of pathology types for each area in more detail.

6.2.2. Pathology by Type

The criteria used for recording (see 3.2.4) are ideal for looking at pathology by broad nosological classification. These are: bone formation, bone destruction, fracture, alteration of shape, alteration of size and other. Dental pathology is categorised separately.

In numerical terms, alteration of shape is the second most recorded lesion type (see Fig. 6.8). However, this is artificially inflated by chondrodystrophy; if a single chondrodystrophic dog survives with all limbs intact, then every limb will be recorded as 'alteration of shape' due to its condition. This may mean as many as ten lesion records for a single dog (e.g. left and right humerus, radius, ulna, femur and tibia). Bone formation is the next most common class of lesion, followed by fractures. Alteration of size is an extremely rare type of pathology.

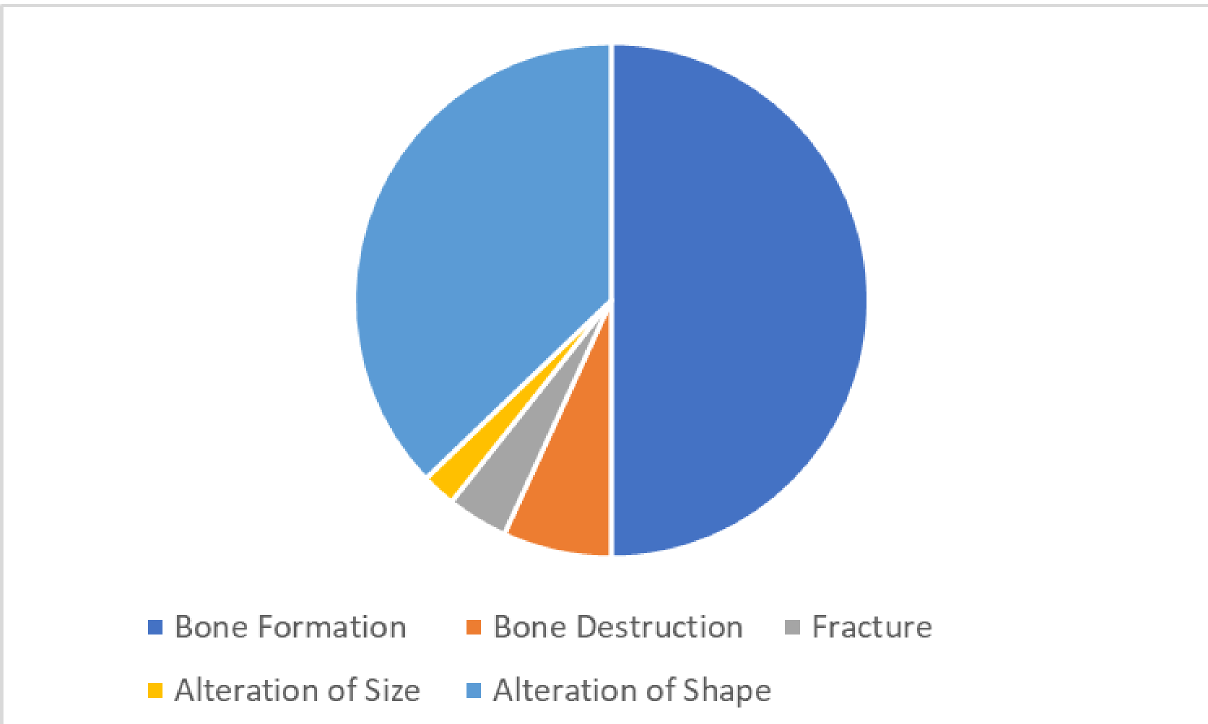

Fig. 6.8. Type of postcranial pathology, as a percentage of total lesions.

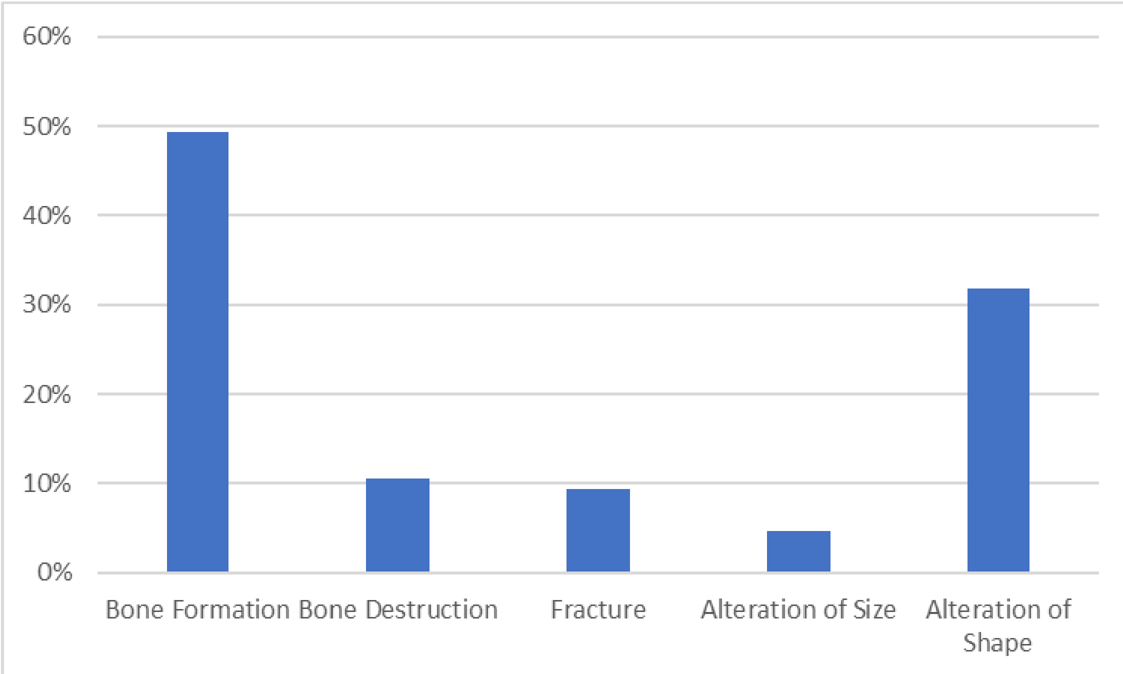

Fig. 6.9. Type of postcranial pathology, counted as a percentage of individual ABGs affected.

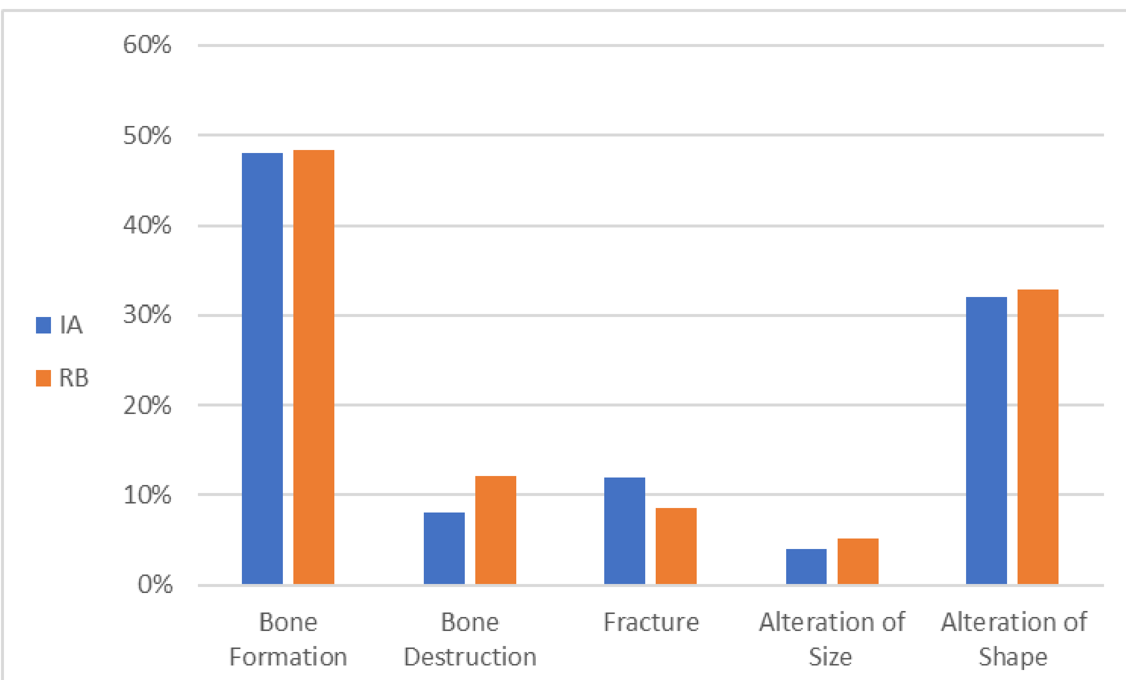

Fig. 6.10. Postcranial pathology type by phase, as percentage of individual ABGs affected.

When pathology is counted per *individual,* not lesion, then the balance changes slightly in Fig 6.9. Bone formation remains the most common affliction, but alteration of shape is more representative of ABGs, and bone destruction and fractures make a higher proportion of the total. Unlike pathology location, type proportions from the Iron Age to the Roman period change little, aside from a slight increase in shape alteration and bone destruction. The percentage of ABGs affected by fractures also drops (Fig. 6.10).

Bone formation may be common due to its positive affect on bone taphonomy. As it adds bone matter, it may promote an increase in bone mass or mineralisation. Conversely, the low rate of bone formation may be linked with its tendency to decrease bone mass and thus reduce the likelihood that it survives (Bartosiewicz 2008: 73).

Pathology Types in Detail

Each broad type covers a huge range of pathology. Just as bone formation was the most common major class, are there specific sub-types of pathology that are commonplace *within* the groups?

Bone Formation

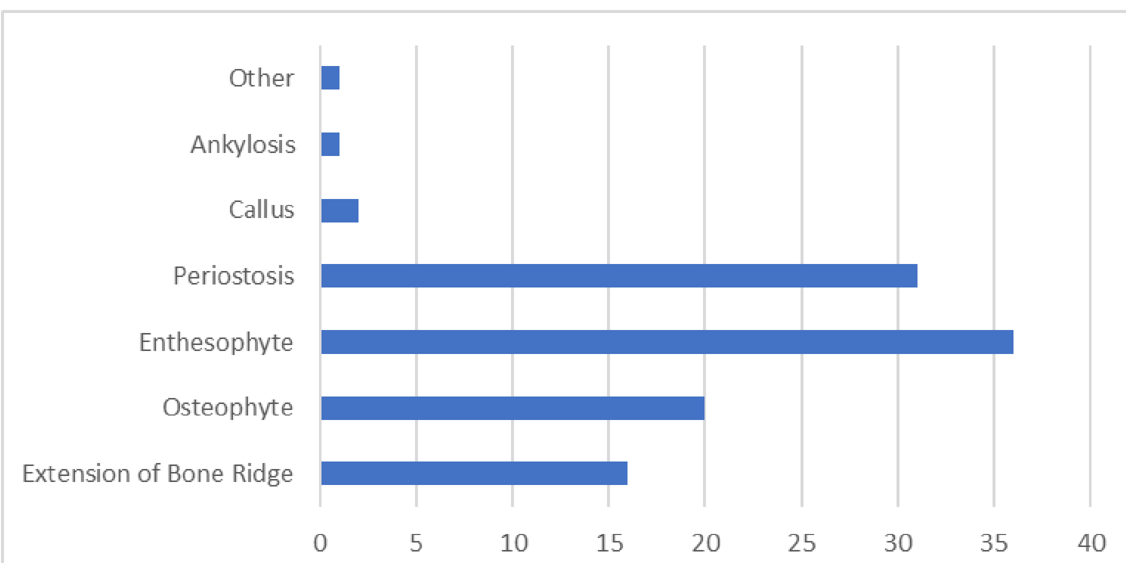

Fig. 6.11. Frequency of bone formation by sub-type.

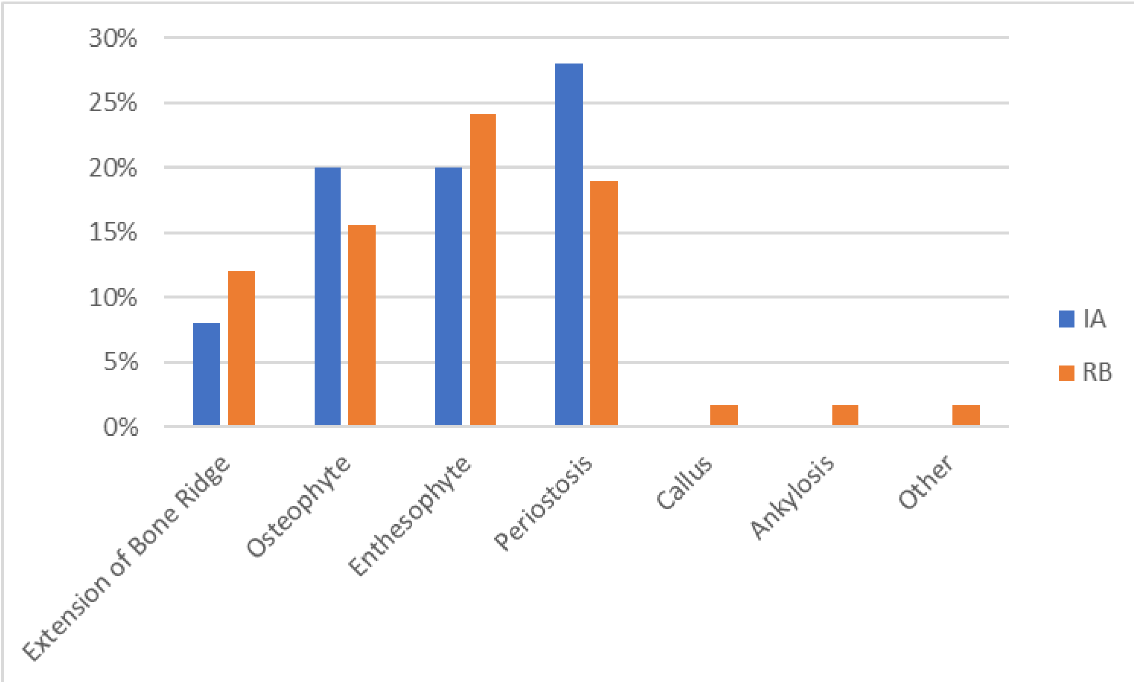

Fig. 6.12. Types of bone formation between Iron Age and Roman ABGs. As total % of each phase.

Most types of bone growth are well-represented, although calluses, ankylosis (bone fusion) and miscellaneous types of pathology are rare in Fig 6.11. Periostosis and enthesophytes are slightly more common than extension of bone ridge and osteophytes. Given that bone formation is the most common pathology type, there is an opportunity to compare specific types between the Iron Age and Roman ABGs. There are no major differences between the two periods (Fig 6.12), aside from a higher percentage of periostosis in Iron Age ABGs. Smaller differences can be seen in the proportions of bone ridge extension, osteophytes and enthesophytes. Otherwise, the Roman period has a more diverse range of the rarer types of bone formation.

Bone Destruction

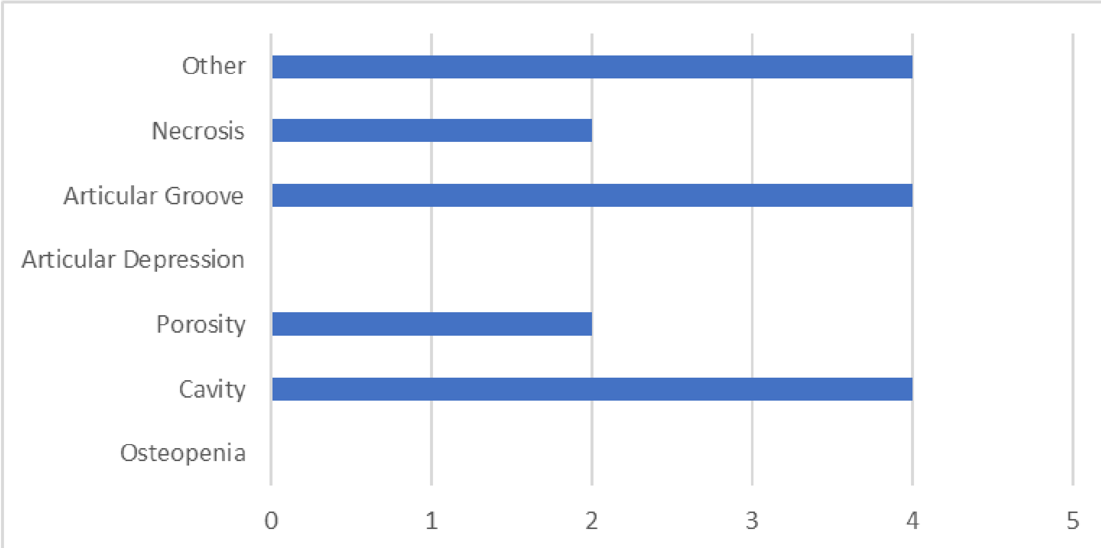

Fig. 6.13. Frequency of bone destruction by sub-type.

As with bone formation, the dataset is mixed, with a couple of sub-types absent (Fig 6.13). Articular depressions and osteopenia, both relatively uncommon lesions in dogs, were not present. The former may be affected by the lower survival of long bone epiphyses (see 4.3.2). Within the 'other' category are two cases of eburnation (see BAL 485-4 and FB-1 in Appendix C), symptoms (but not diagnostic by themselves) of osteoarthritis (Bartosiewicz and Gál 2013: 128). The other cases in this category are anomalous grooves with no discernable cause.

Fracture

Although there are only nine fractures, all on separate ABGs, it is worth looking at the type and location. As Fig. 6.14. shows, they are mainly oblique, with individual cases of incomplete, impacted and transverse fractures. Part of this may be due to taphonomy: in the archaeological record, animals with open and comminuted fractures may be less likely to survive, with infection a likely cause of death. Bones that have broken shortly *pre-* or *peri-mortem* are difficult to distinguish from those that were broken *post-mortem* due to the absence of healing signs (Bartosiewicz 2013: 101, 175). It is noteworthy that all fractures in this dataset were, at the very least, in the process of healing. No compound fractures (see 3.2.4) were noted.

Four fractures were found on long bones, and two on ribs. One unusual case was found on the spinous process of an axis (see BAL 485-3 in Appendix C) and another on the acetabulum of the pelvis (see Chapters 7 and Appendix A for further discussion). Only one fracture was found on the cranium (see GY-7 in Appendix C).

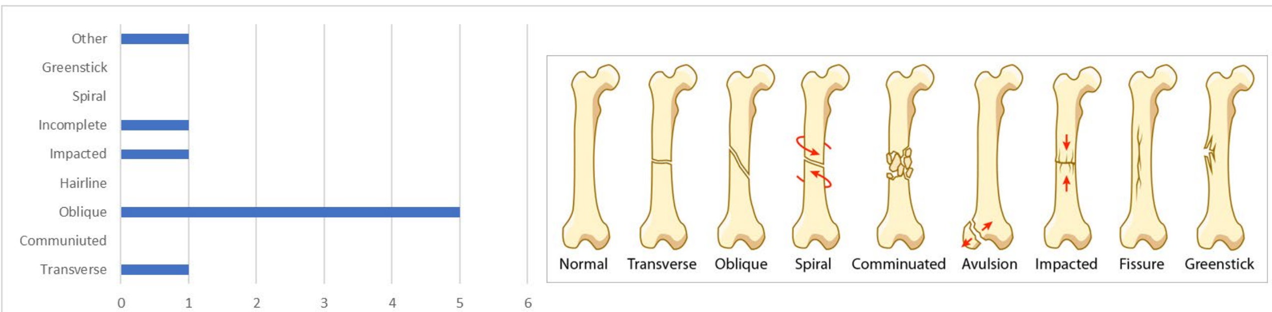

Fig. 6.14. Frequency of fracture by sub-type (image: Arizona Science Center 2011).

Alteration of Size

Alteration of size was rarely observed and only five cases were noted in total. It is still interesting, however, that all cases were of enlarged bones. Two cases were of swollen metaphyses in long bones (see 6.3 for diagnosis). The other cases were found on the caudal vertebrae, two on the long bones and one phalanx. The enlargement of the vertebrae were not symmetrical and affected the processes of the right side (see Appendix E for details). However, the clinical literature on vertebral asymmetry concerns the other vertebrae, particularly the lumbar. As the enlargement is of otherwise identical shape to the smaller side, with no swelling or spongy bone, the issue may be a benign one, perhaps congenital.

Alteration of Shape

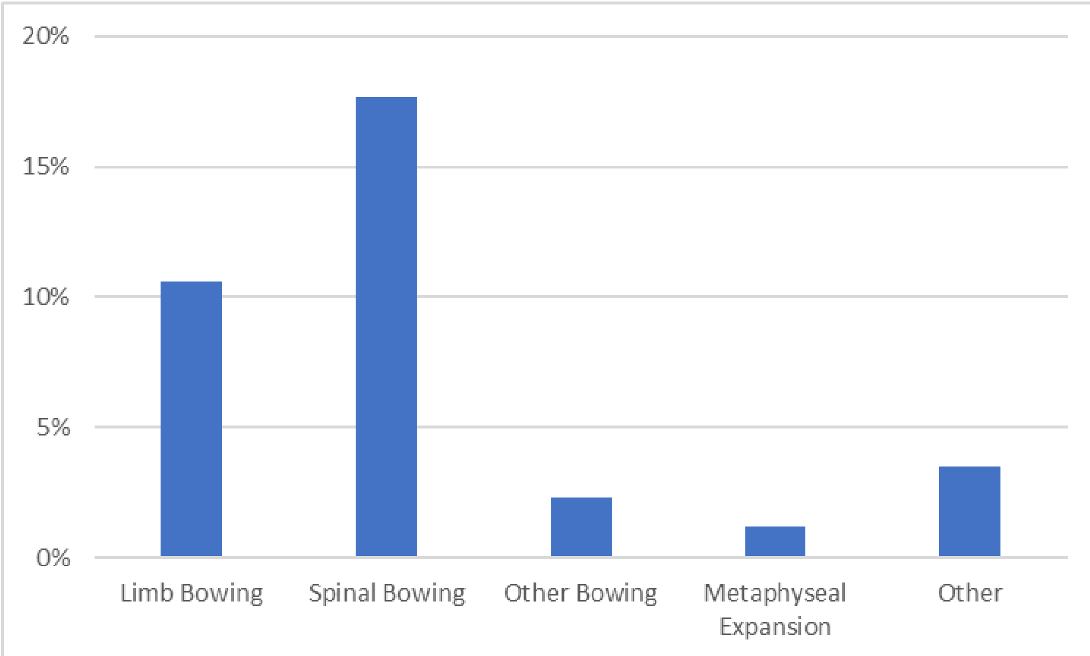

Fig. 6.15. Frequency of shape alteration by sub-type, as a percentage of total ABGs.

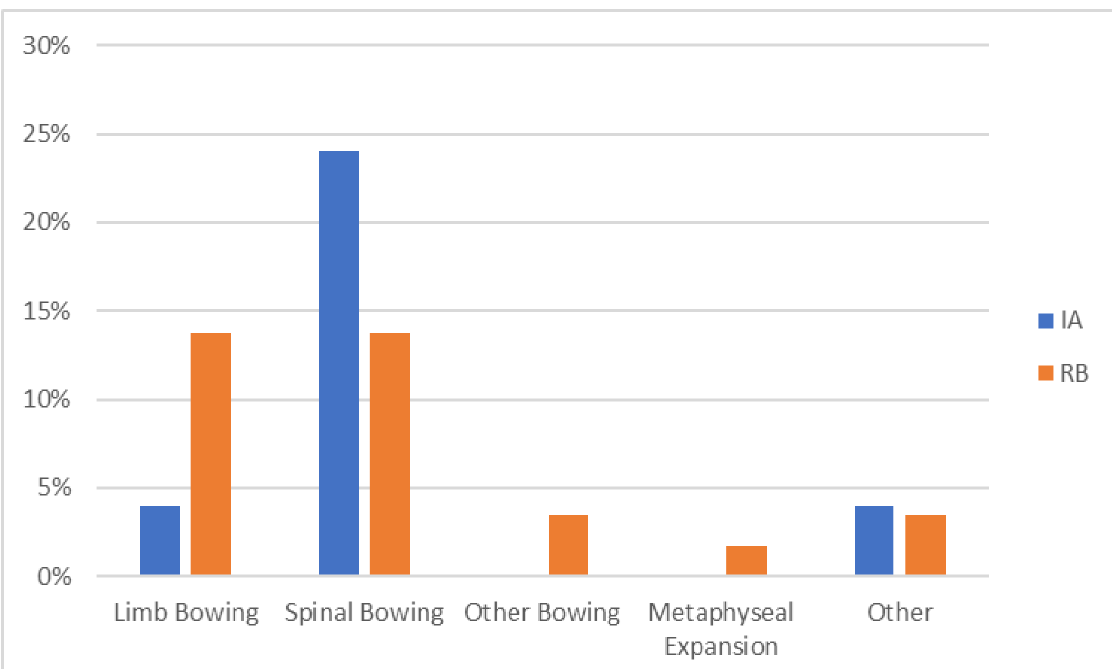

Fig. 6.16. Frequency of shape alteration by sub-type, as a percentage of total ABGs by phase.

Almost all pathology in this category was the product of bowing of long bones or spinous processes (see Fig. 6.15). However, one case of unusual metaphyseal expansion was found. A radius on BAL 252-3 showed signs of expansion on the distal metaphysis of the radius (Appendix E). Although this could not be definitively diagnosed, there are a couple of possibilities. Hypertrophic osteopathy, a developmental disorder of unknown aetiology (Lenehan and Fetter 1985), is possible, as are bone cysts (Kealy *et al.* 2010: 437).

However, there are two major types of bowing in this dataset: bowing of the limbs, which is usually caused by chondrodystrophy (congenital shortening of the long bones; Brown *et al.* 2017: 11476-77) The other type is deviation of the spinous processes of the vertebrae, which has several potential causes (see 6.3.1 for aetiology discussion). Spinal bowing is the most common of the two types, at nearly one and a half times the frequency of limb bowing per ABG (Fig. 6.16).

Given that the Roman period is associated with an increase in canine morphotypes, particularly small ones, we may expect to see a much higher rate of limb bowing. As Fig. 6.16 shows, there is an increase in the frequency of bowed long bones in the Roman period. Only one Iron Age ABG, or only 4% of the total, shows any limb bowing. By contrast, eight Roman ABGs, making up 14% of the total, have bowed limbs. Both periods have a notable frequency of spinal bowing, but it is somewhat more common in the Iron Age at 24%.

Comparing Urban and Rural Sites

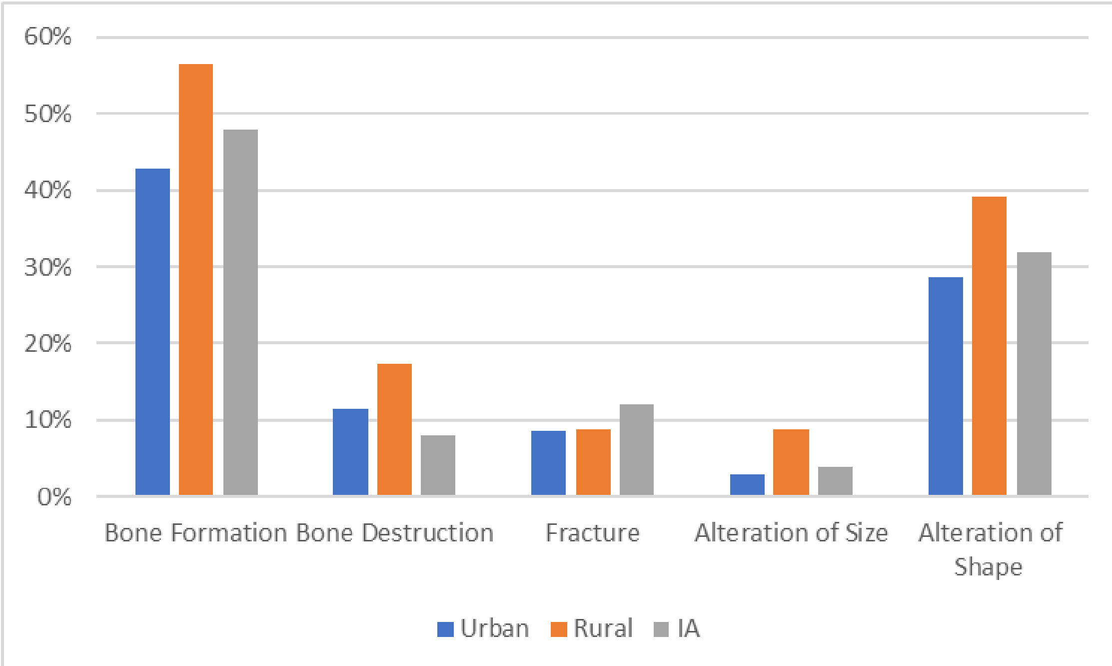

Fig. 6.17. Percentage of ABGs with lesions by pathology type and site type.

The Roman dataset may be divided into two sub-categories: rural and urban sites. Most pathology is higher on rural sites than urban, but the general patterns are similar between categories. Bone formation and alteration of shape are the most common types, with bone destruction, fracture and alteration of size mostly affecting 10% (or fewer) of ABGs (Fig. 6.17). Interestingly, alteration of shape is more common on rural sites, despite the fact that more urban sites have small dogs that are prone to this type of issue.

Unfortunately, unlike 6.2.1, the pathology types are mostly too different to compare against secondary data from a previous study (Bellis 2018). For instance, two of the categories used in the aforementioned study are ‘Infection’ and ‘Congenital’: these cover several pathology type categories. However, it is possible to explore bone growth and fractures in more detail.

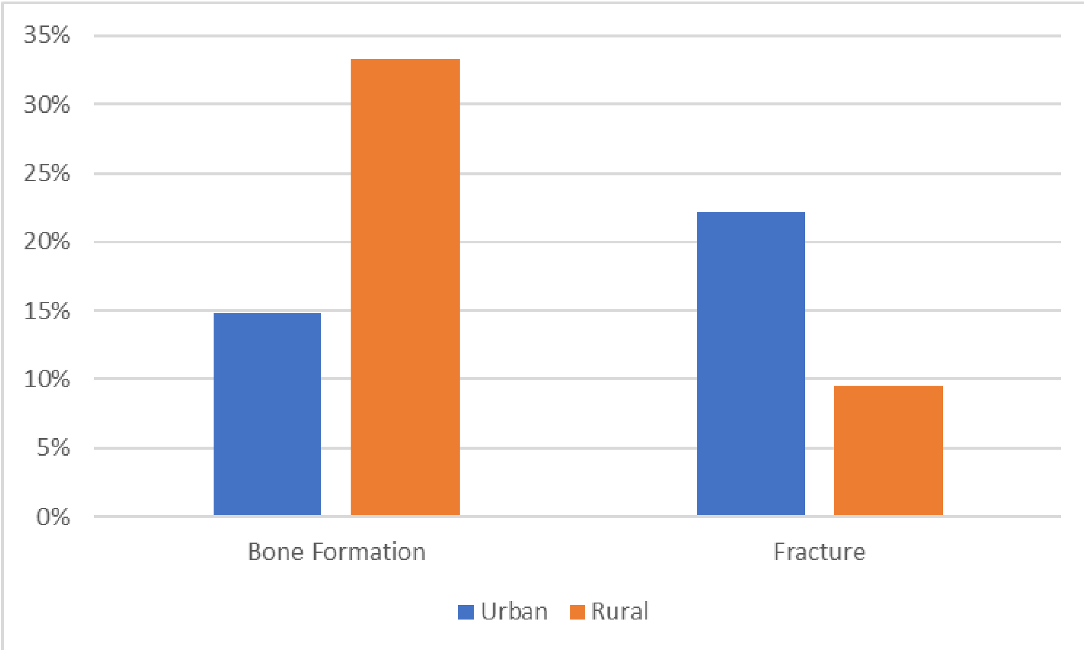

Fig. 6.18. Percentage of secondary ABGs with bone formation and fractures, by site type (from Bellis 2018).

The analysis reveals that bone formation occurs much less frequently in the ABGs from other publications, as shown in Fig 6.18. This may be under-reported, as much of the bone formation in the primary data were small lesions that may be missed by analysts. This may particularly affect those ABGs that were analysed 30-40 years ago, when animal palaeopathology was less developed. The urban-rural pattern is interesting: as with the primary data, there are more ABGs with bone formation on rural sites, but the difference is much more striking.

Conversely, fractures are much more common in the published literature. Again, this may be due to selective reporting as fractures are one of the easiest types of pathology to identify. Many of the secondary ABGs recorded came from sites with other dog ABGs that were not reported in the text. This may be due to a lack of interesting pathology, thus inflating the proportion of reported ABGs that have it. It is difficult to know what to make of the higher rate of fractures in urban dogs: this is something I will consider further in Chapter 7.

Pathology Sub-Categories

Bone formation and shape alteration, as the most common lesion types, can be analysed in further depth, for example, to explore whether particular *types* of bone formation are more or less common on urban sites. It is notable that, of the main four types of bone formation, rural ABGs have higher frequencies than urban *except* for osteophytes (Fig 6.19). The proportion between Roman sites and the Iron Age varies somewhat, with the latter matching urban sites for some sub-types and rural sites for others (periostosis).

When sorted by site type, the types of bowing (described earlier in this section) exhibit interesting differences in Fig 6.20. Spinal bowing is present in c. 25% of rural and Iron Age ABGs, but only 6% of urban specimens. On the other hand, limb bowing is rare on Iron Age sites but more common on Roman rural sites, followed by urban sites.

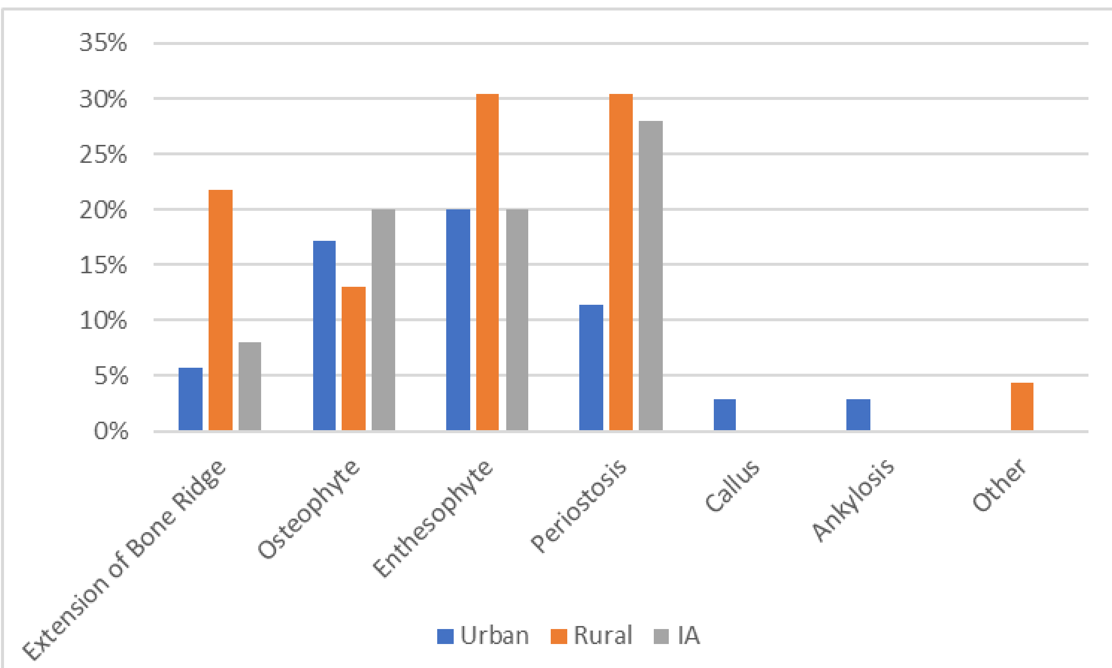

Fig. 6.19. Types of bone formation between urban, Roman rural and Iron Age sites. As a percentage of ABGs for each category.

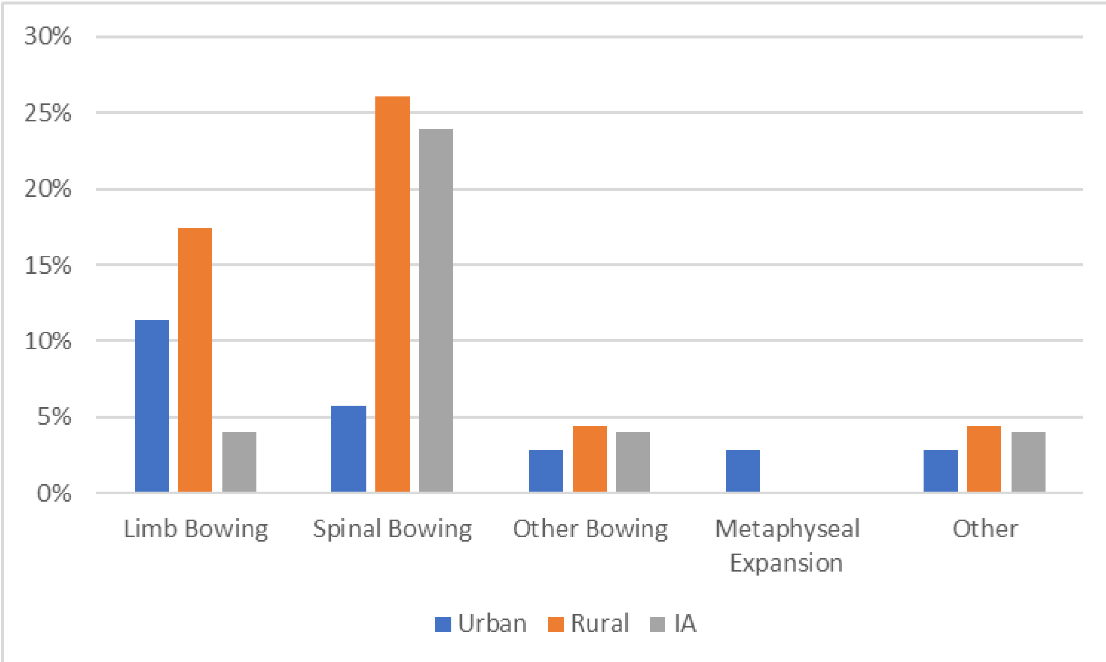

Fig. 6.20. Types of shape alteration between urban, Roman rural and Iron Age sites. As a percentage of ABGs for each category.

6.2.3. Combining Location and Type

Having established pathology distribution across the body and in ABGs, it is necessary to link these two variables together. Patterns in where certain pathology types are found may be discerned, if present.

Pathology Location by Type

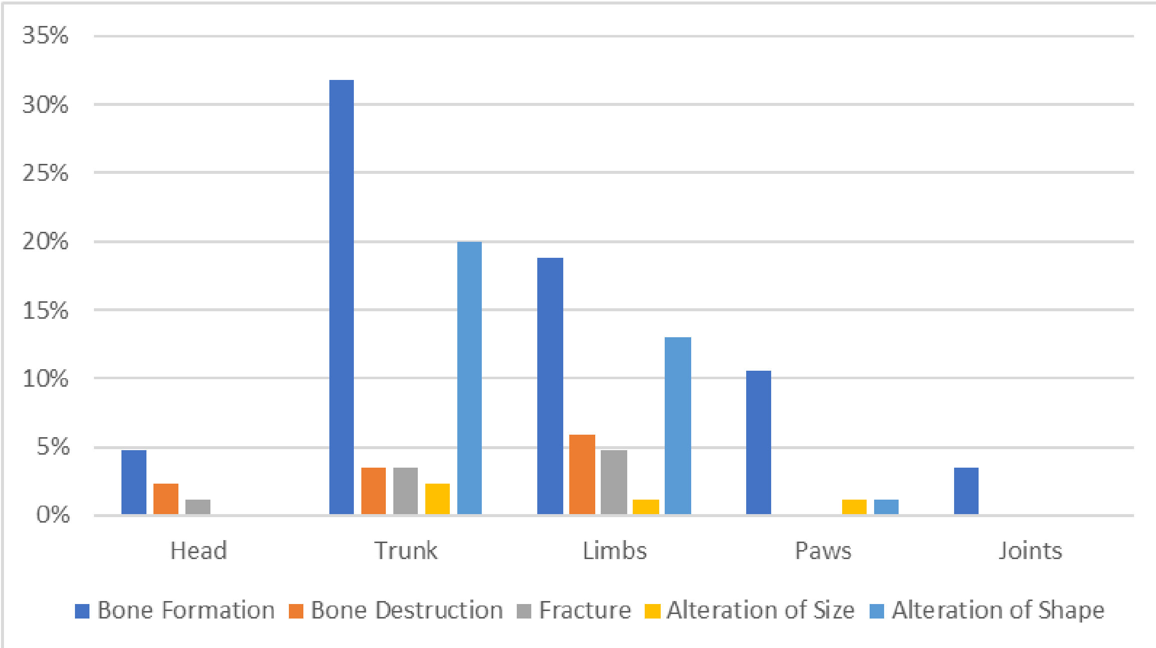

Fig. 6.21. Pathology location, subdivided by type, as a percentage of affected ABGs.

Bone formation is the most common lesion for all parts of the skeleton (see Fig. 6.21). However, for the trunk and limbs, shape alteration follows closely behind. It is extremely uncommon or absent elsewhere: given that the paw and joint bones are very small, shape alteration may be more difficult to observe. Bone destruction and fractures are much less common, and are also absent from the paws and joints, perhaps for the same reason. The rarest type, alteration of size, is present in a minute number of ABGs on the trunk, limbs and paws.

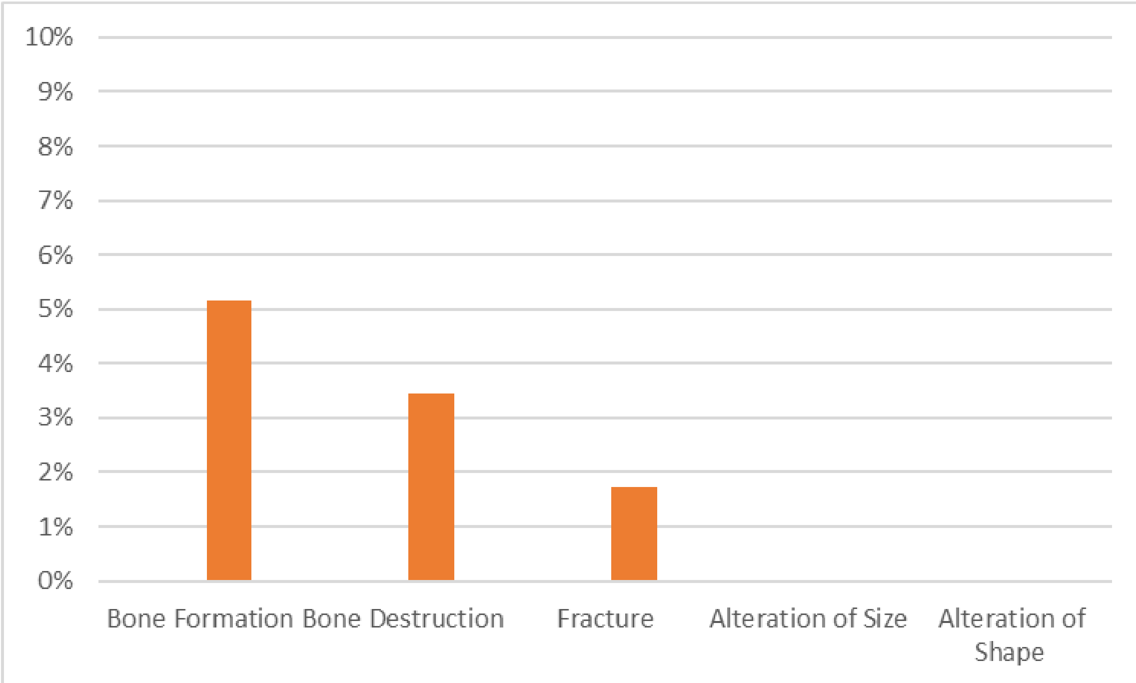

Fig. 6.22. Pathology types for the head (as a percentage of affected ABGs), sorted by phase.

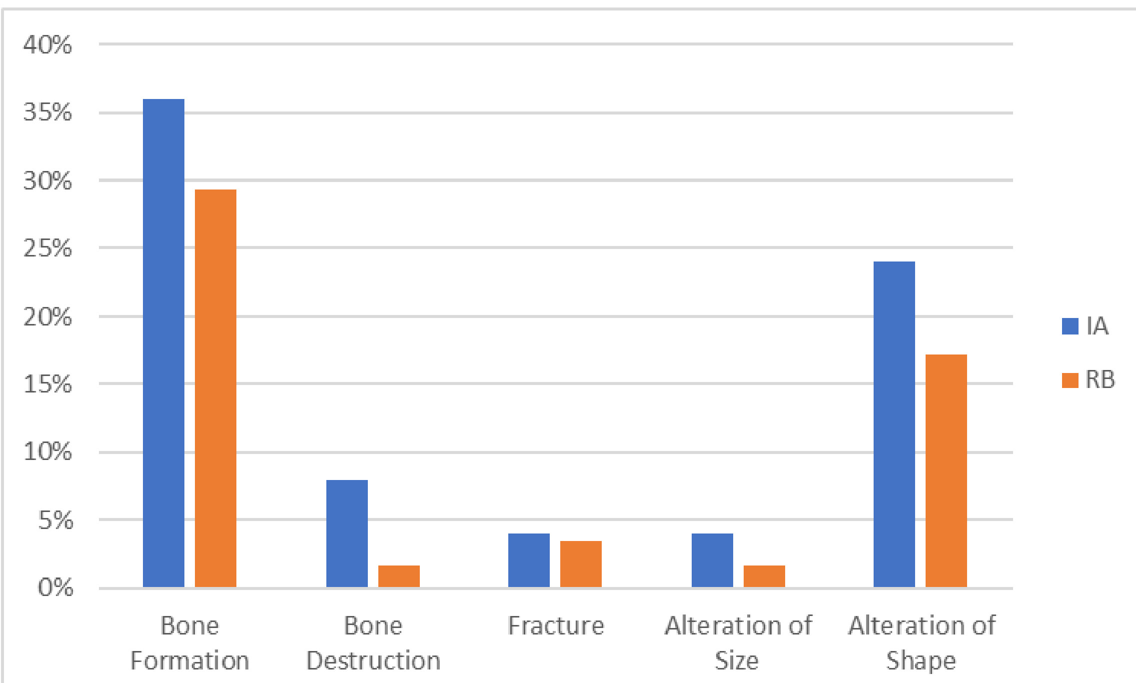

Fig. 6.23. Pathology types for the trunk (as a percentage of affected ABGs), sorted by phase.

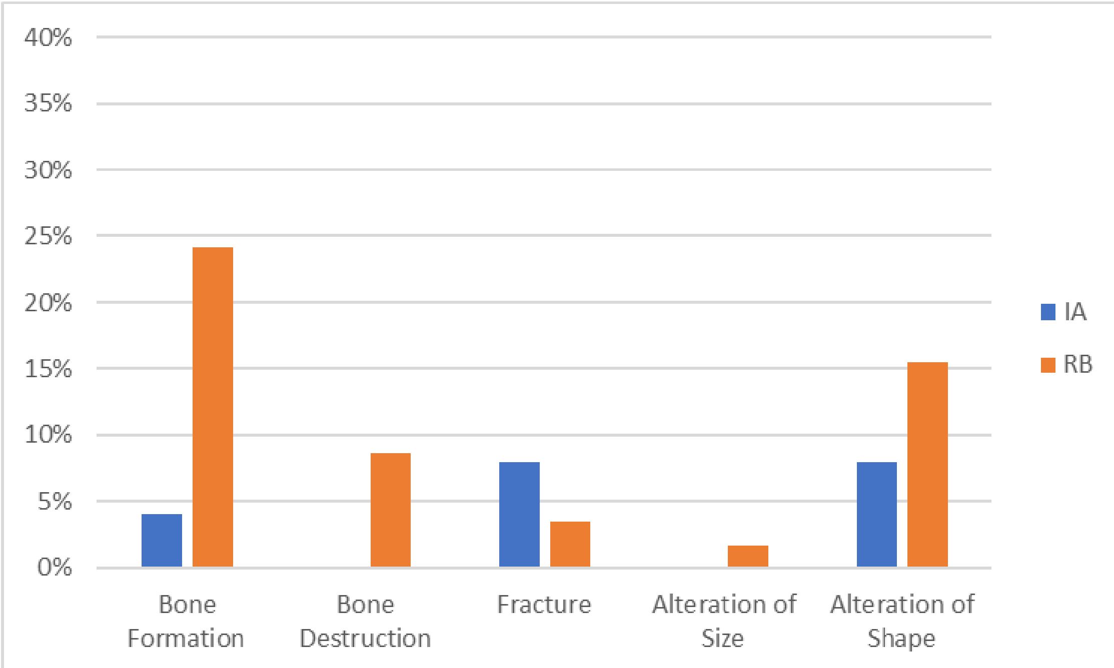

Fig. 6.24. Pathology types for the limbs (as a percentage of affected ABGs), sorted by phase.

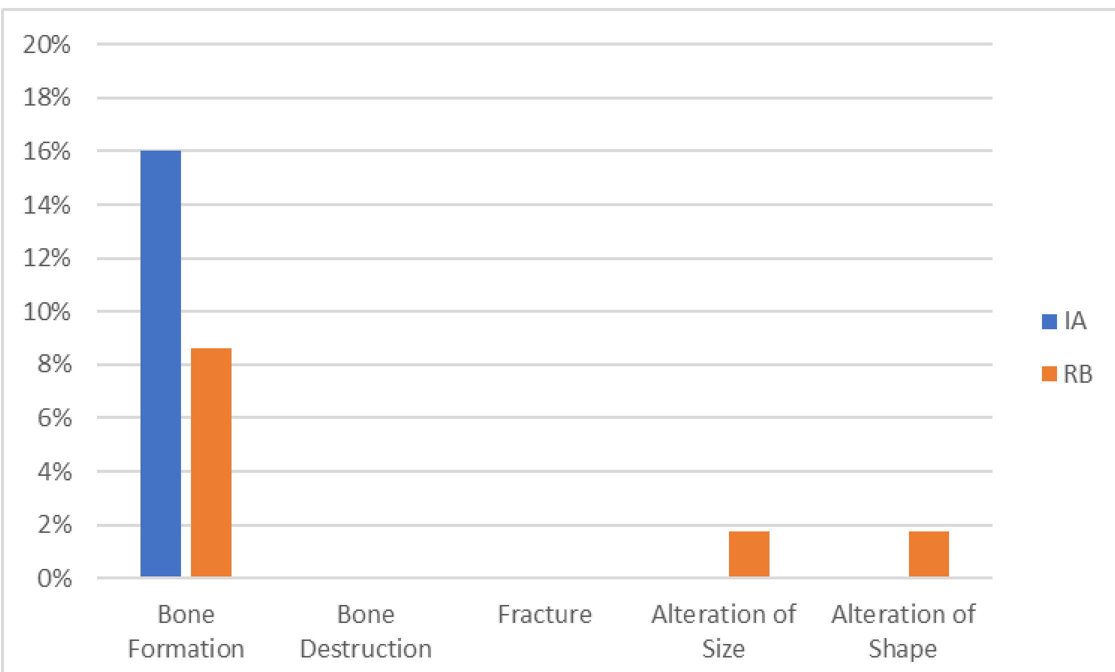

Fig. 6.25. Pathology types for the paws (as a percentage of affected ABGs), sorted by phase.

There are notable differences between Iron Age and Roman lesion prevalence: there is no non-dental head pathology in the Iron Age collection. Thus, Fig. 6.22. only shows pathology for Roman specimens. Pathology in the trunk follows a similar pattern for the phases (Fig. 6.23): the main difference is that the frequencies are higher in the Iron Age, overall. More Iron Age ABGs have paw pathology than Roman ABGs, but the types found are less diverse: neither phase shows signs of bone destruction or fractures, and alteration of size and shape are rare (Fig. 6.25). As stated before, this may be due to the difficulty in observing these types of lesions on such small bones.

The temporal differences in limb pathology are much greater (Fig. 6.24). In Iron Age specimens, the percentages are very low, and only the proportion of fractures are higher than the other phase. By contrast, the Roman individuals have relative frequencies of each type that are comparable to the patterns of Roman trunk pathology. Overall, pathology is different between the trunk and limbs in the Iron Age, but similar in the Roman period; possible reasons will be discussed at the end of the section.

Adjusting Pathology and Location by ABG Completeness

There is little to be gained by focusing on the head and paws, given their low levels of pathology, but the trunk and limbs are worth further investigation. In 6.2.1 it was established that, when adjusted, trunk pathology frequency is similar in both phases. The next step is to consider whether these trends are consistent across different types of pathology.

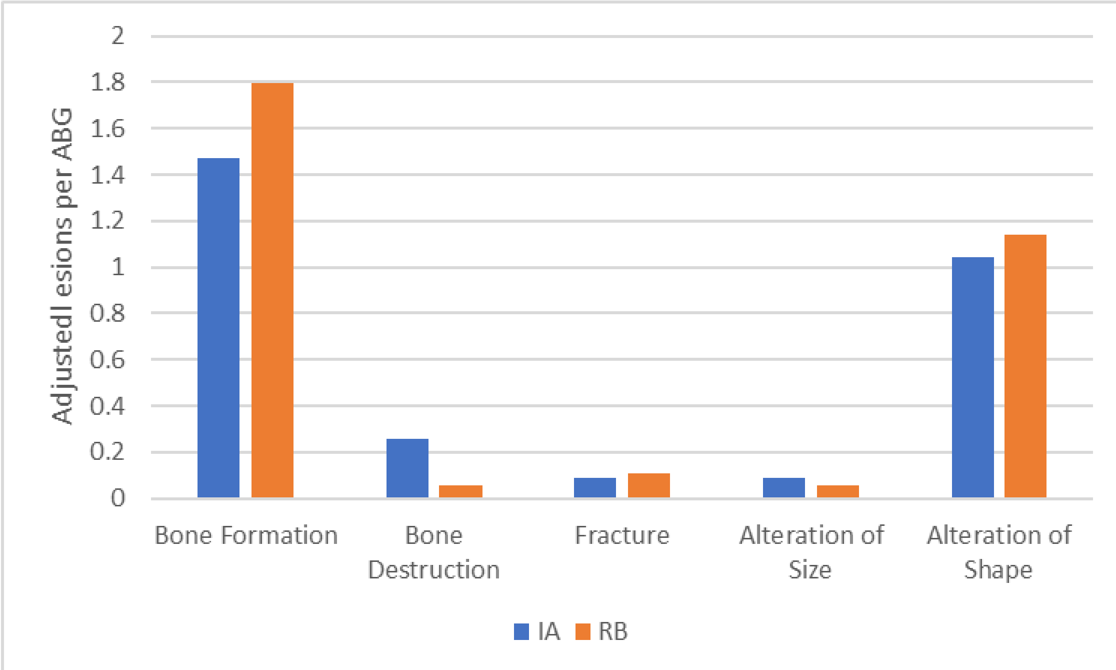

Fig. 6.26. Average number of trunk lesions per ABGs, when adjusted against completeness. Compared by phase.

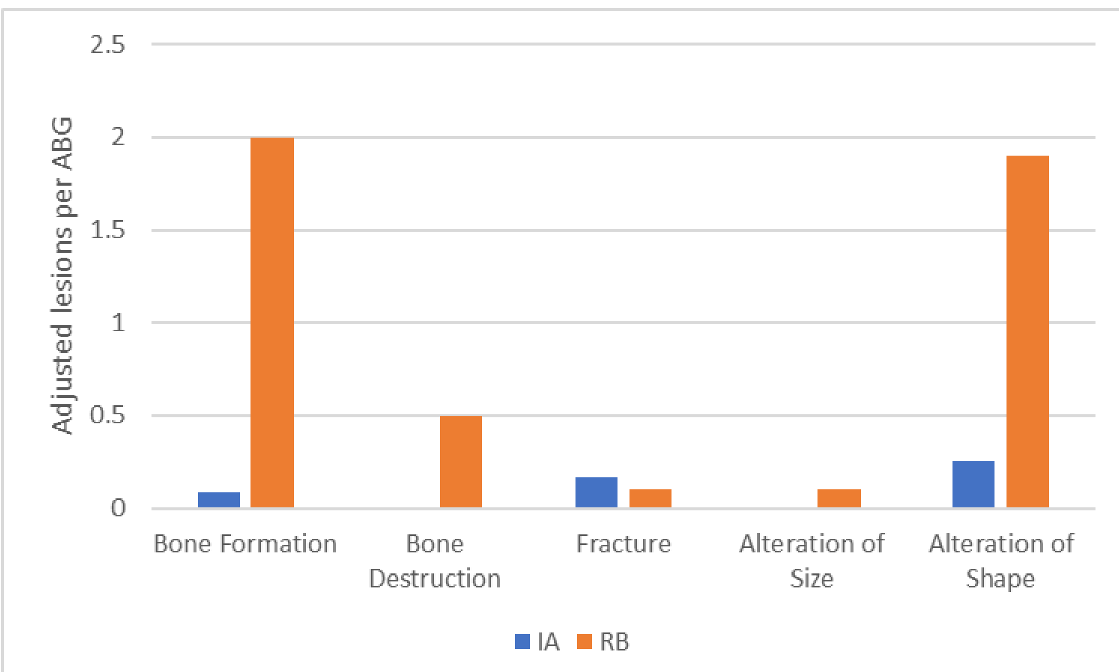

Fig. 6.27. Average number of limb lesions per ABGs, when adjusted against completeness. Compared by phase.

Using the same method outlined in 6.2.1, relative frequencies of trunk pathology vary little from Fig. 6.26. On the whole, the differences between the Iron Age and Roman period are narrow, with the only noteworthy variation being a higher frequency of bone destruction in the Iron Age, and a slightly higher percentage of bone formation in the Roman period (Fig. 6.27). By contrast, the limb pathology types show greater disparity. Most of the differences in 6.2.1. are due to bone formation, alteration of shape and to a lesser extent bone destruction. There is little difference in alteration of size, and the rate of fractures is slightly higher in the Iron Age.

6.2.4. Dental and Specific Pathology

Which Teeth?

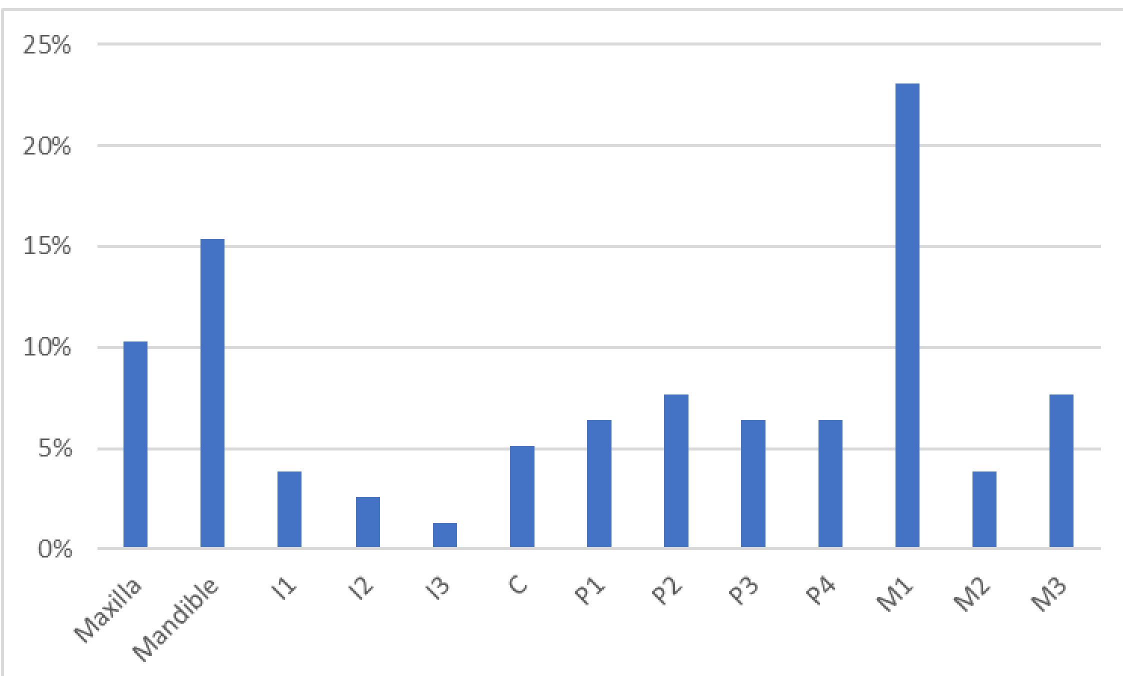

Fig. 6.28. Percentage of teeth affected by pathology.

In section 6.1.2, I discussed the teeth survived and which were lost after death. Of those that remain, some were afflicted by pathology far more than others. Fig. 6.28 shows that the most common tooth to be affected by pathology, by a considerable degree, is the M1.

Some variation is present between the other teeth. Incisors, for instance, have less pathology than the premolars and molars and pathology that affects the entire mandible is 50% more common than in the maxilla. This may be due to preservation: the maxilla is more likely to be found in small parts, so pathology is more difficult to identify.

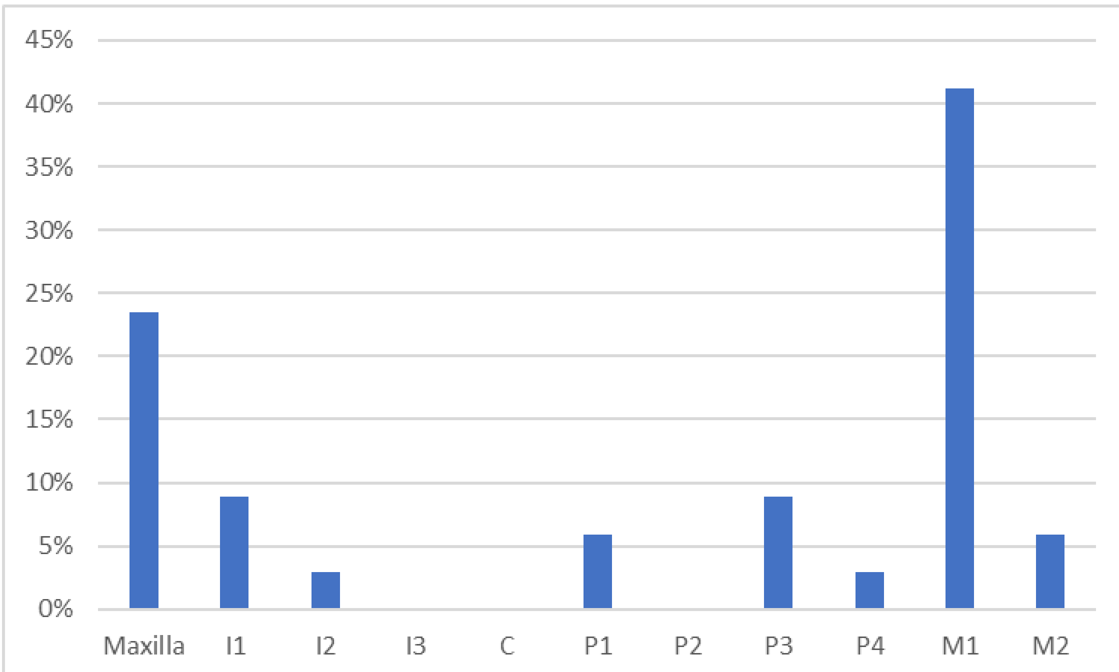

Fig. 6.29. Percentage of maxillae and maxillary teeth affected by pathology.

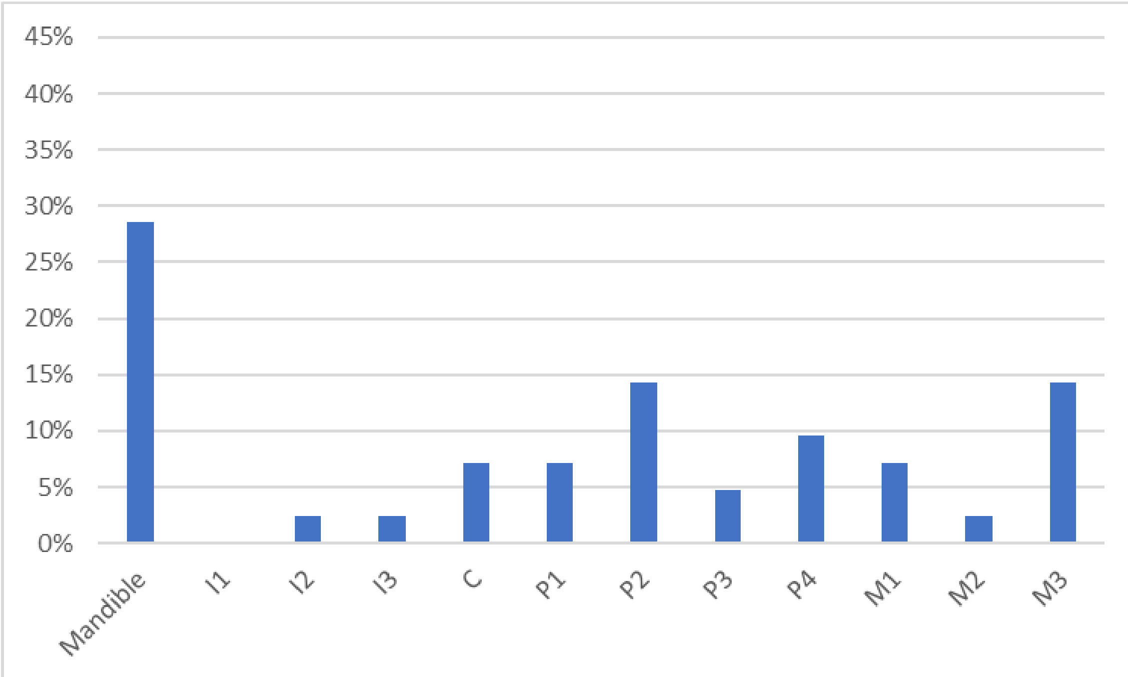

Fig. 6.30. Percentage of whole mandibles and mandibular teeth affected by pathology.

When separated into maxillary and mandibular categories, most M1 pathology is located on the upper molar (see Figs. 6.29 and 6.30). This is likely due to a high frequency of cavities, discussed below. Otherwise, there are minor differences: pathology is more consistent across the lower teeth. The better mandible preservation is the likely cause: fewer maxillary teeth survive overall (see 4.3.2). Of the lower teeth, the second premolar and third molar have the highest frequencies of pathology. The third molar is frequently absent congenitally.

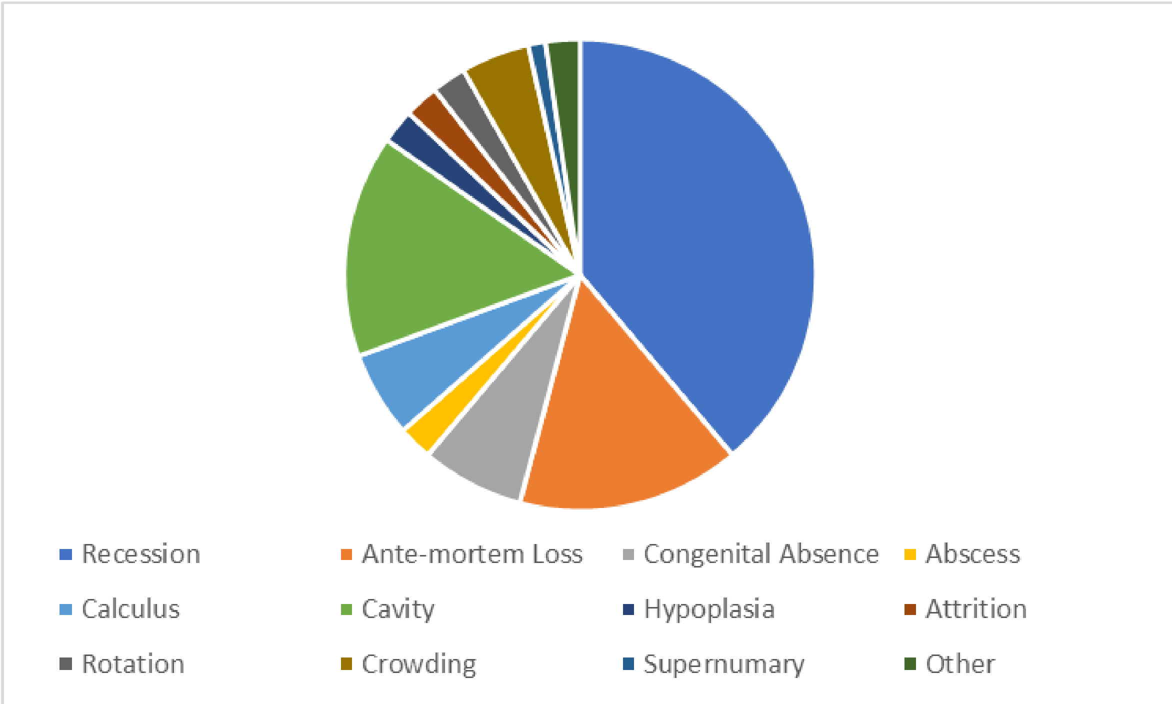

Fig. 6.31. Types of pathology, as a percentage of total dental lesions.

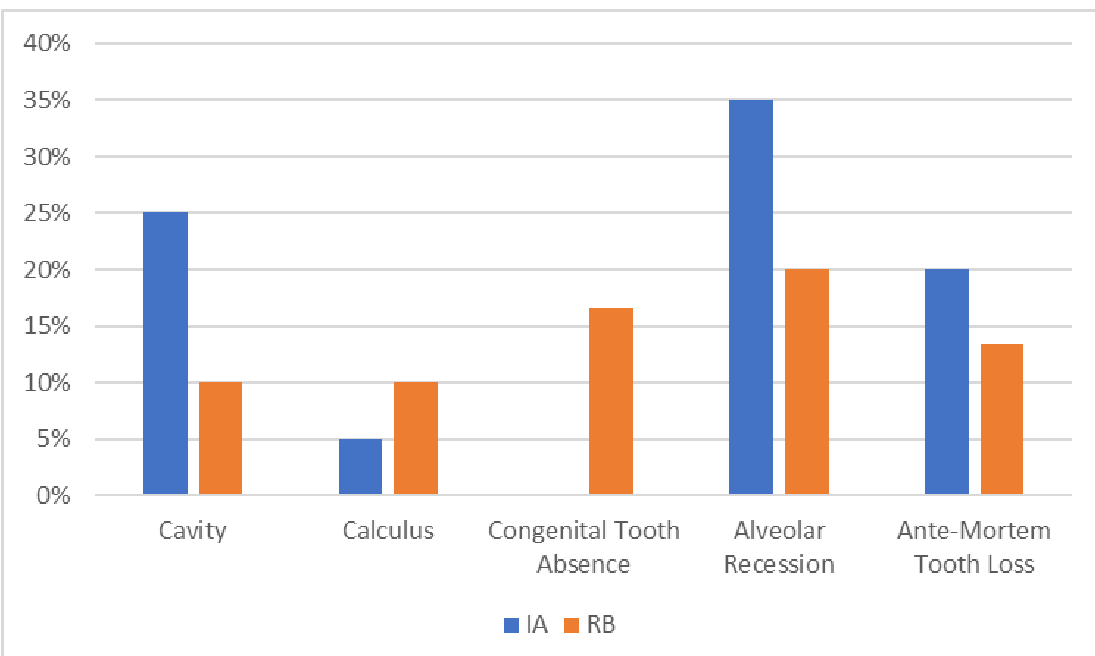

Fig. 6.32. Types of pathology by phase. As a percentage of ABGs affected.

The most common type of dental pathology is alveolar recession (Fig. 6.31). The next most common lesions are ante-mortem tooth loss and cavities, followed by congenital absence of teeth and calculus. Other types are rare, with only one or two lesions in total. While alveolar recession is the main indicator of periodontal disease, ante-mortem tooth loss, calculus and cavities may also be signs (Hammerl 2013: 279-280).

When the most common types are compared, there are major differences between the Iron Age and Roman ABGs (Fig. 6.32). Congenital tooth absence, while affecting 1 in 6 Roman ABGs, is unknown in Iron Age specimens. Conversely, cavities and alveolar recession are much more frequent in the Iron Age. While calculus is more common in Roman dogs, this is perhaps the least reliable of the results: it is very easily removed during post-excavation processing (Worley, pers. comm). Its higher presence in the Roman ABGs may be just as much due to more thorough post-excavation processing for the major Roman sites, or sheer chance, than a genuine difference. At any rate, it is probably under-represented in both datasets. Overall, more Iron Age dogs may have been afflicted by periodontal disease than Roman.

Alveolar Recession

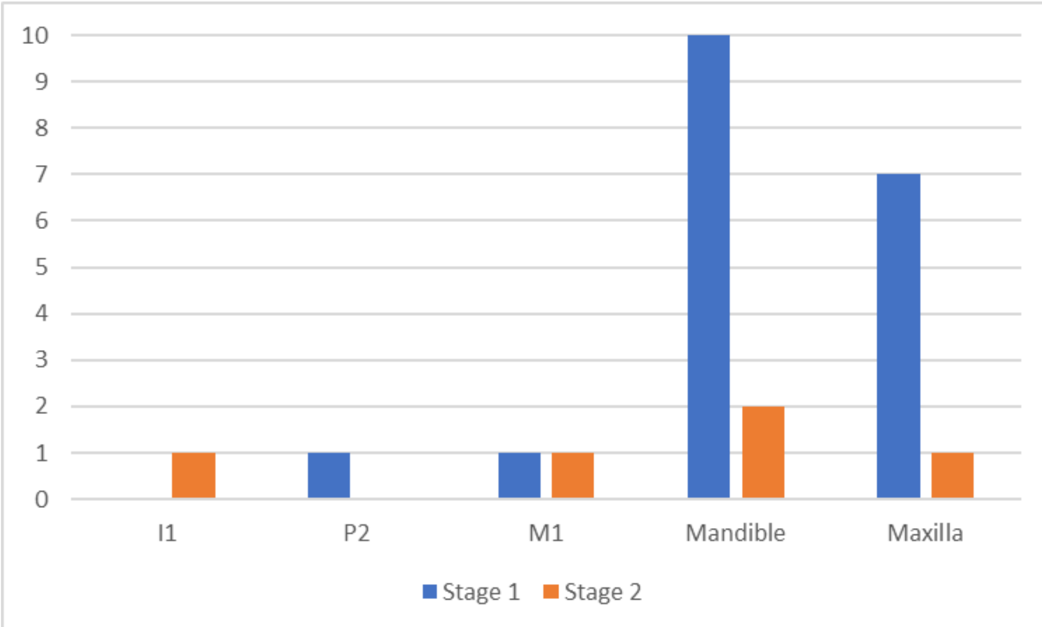

Fig. 6.33. Percentage of ABGs affected by alveolar recession, tooth or bone.

Alveolar bone lines the sockets of the teeth and provides structural support; when the gums are inflamed by periodontal disease, this may spread and cause bone loss (Chu *et al.* 2014: 231-233). Alveolar recession mostly affected whole mandibles or maxilla (see Fig. 6.33), and occasionally it affected more localised areas around teeth. The majority of recession was in Stage 1, which was 'recession of alveolar margin only'. Stage 2 recession, which was more severe at 'alveolus widened postmortem, plus more recession', was much rarer (see 3.2.4). This indicates that while around 15-20% of dogs had periodontal disease, most cases were in early stages. Stages 3-5 cover stages of ante-mortem tooth loss, rather than recession around gums and teeth, so have been counted in that section instead.

Ante-Mortem Tooth Loss

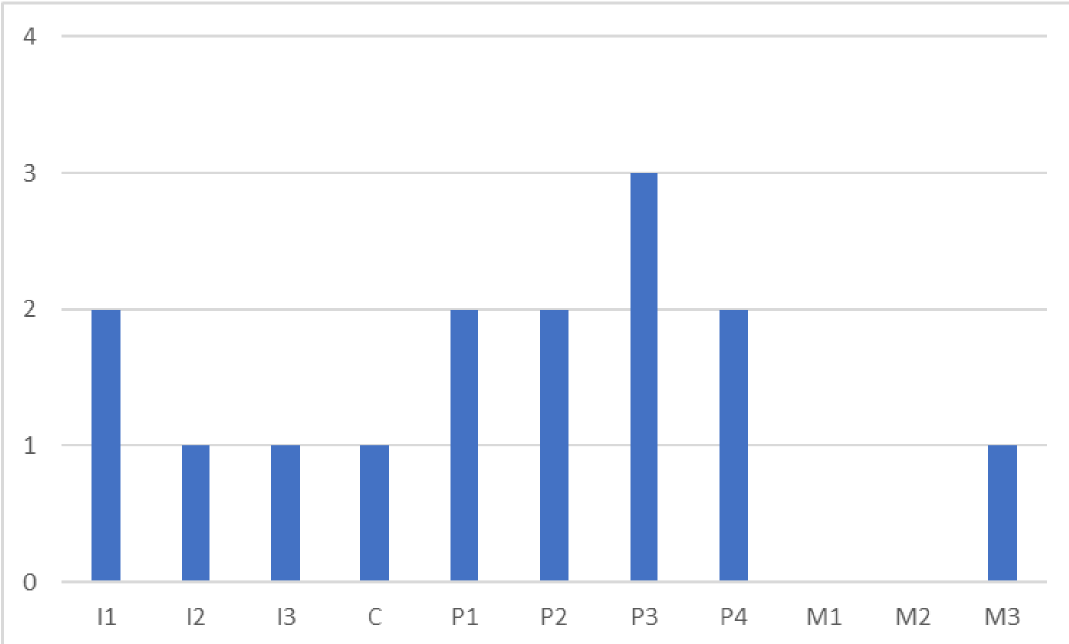

Fig. 6.34. Percentage of ABGs affected by ante-mortem tooth loss.

Thirteen teeth were lost ante-mortem, coming from seven different ABGs. The teeth did not come from only one or two particular areas of the mouth: nearly all were represented (see Fig. 6.34). Generally speaking, the molars were much less likely to be lost. Ante-mortem tooth loss in incisors and canines may be under-represented, as the front parts of the mandible and maxilla were less likely to survive (see 6.1). However, a study of dogs and wolves in the arctic found that premolars were more commonly lost than incisors, canines and molars respectively, with the caveat that exact proportions varied amongst populations (Losey *et al.* 2014: 5).

Cavities

Cavities were one of the most common pathologies, with a total of 15 lesions. Almost all of these were the upper M1, with only one upper M2 and one lower M3. This pattern is consistent with veterinary literature, which notes the maxillary molars to be the most commonly afflicted by caries (Hale 2009: 1302). However, most lesions fell into Stage 1 (noted by Hillson as 'white or stained opaque area in enamel with smooth glossy or matte surface'), with only 5 at Stage 2 ('white or stained opaque area with associated roughening or slight surface destruction') and 1 at Stage 3 ('small cavity where there is no clear evidence that it penetrates to the dentine'; 2005: 298) (see NC-2 in Appendix C). Relative to photographs of modern dogs with cavities that penetrate the dentine and even the pulp (see Fig. 6.35), the Iron Age and Roman examples may perhaps be regarded as 'pre-caries'. They show that the dogs had the early stages of tooth breakdown from bacteria, but never to any severe extent.

Fig. 6.35. Picture of a modern dog with caries of the upper first molar (Bellows 2016).

Congenital Tooth Absence

Congenital tooth absence (otherwise known as hypodontia) was uncommon, with only six incidences in total (affecting six ABGs). Previous work on Roman dogs has noted the absence of the third molar (Bellis 2018; MacKinnon and Belanger 2006). Indeed, this was the most common tooth that was absent in this dataset, with four occurrences (see CA-1 in Appendix C). But there were others: one cases were present on the P2 and another on the P4 (see GY-8 in Appendix C). In a study of dental anomalies in dogs referred for dental treatment, absence of the third molar were the most common of all teeth. Absent P2 was also common, but P4 absence was rare. Hypodontia is likely hereditary in nature, but may also be caused by trauma during development. Small size is not a requirement (Pavlica *et al.* 2001: 67-69), although it is interesting that M3 absence usually (but not always) correlates with small mandible size in this project.

Teeth were noted as congenitally absent when either there was no physical room for the tooth, or it was missing on both sides (removing the possibility of ante-mortem tooth loss that fully healed). It is certain that the third molar was congenitally absent, as there was no physical space for a third molar in the mandibles it occurred in. However, other teeth may not be present for other reasons. As Hale notes, some teeth may actually be present in the mandible, but fail to erupt (2003: 1-2). There were other cases where teeth may have been absent, but the diagnosis could not be made with confidence; sometimes the area was poorly preserved or looked like it may have been ante-mortem loss. There were four uncertain cases, each affecting a lower and upper P1 and P2.

Rare Pathology

Abscess

Abscesses were rare, with only two present in the entire dataset. Both were at Stage 2, which is medium grade infection that was visible externally (Levitan 1985: 45). One manifested as a large swelling under the mandibular P2, and the other as bone destruction and a small cloaca above the upper M1 (see DA-10 in Appendix C).

Crowding, Rotation and Attrition

Tooth crowding and rotation were usually found together. Both instances of tooth rotation were found with tooth crowding. These were on a single dog, CA-1, which had severe crowding and rotation on both the upper and lower dentition (see CA-1 in

Appendix C). However, tooth crowding also occurred on two occasions without any tooth rotation in only the lower teeth of BAL 524.

What causes tooth crowding is still not fully certain. While it is much more likely to occur in small dogs (particularly brachycephalic varieties) due to the diminution of the jaw (Tsugawa 2003: 256), it may also occur in large dogs and wolves (Ameen *et al.* 2017). This ambiguity is reflected in the dataset: CA-1 had an exceptionally small jaw, but while the toothrow of BAL 524 was too incomplete to measure, it appeared to be around medium length for a domestic dog.

Unusual attrition occurred separately of rotation and crowding, with only two instances. These comprised of mesial and distal attrition on a mandibular canine, generally noted as unusual wear, and distal attrition on the metaconid of the M1. It is unknown what caused either.

Enamel Hypoplasia

Episodes of severe illness or malnutrition may damage the enamel of developing teeth. The severity can range from a single pit to entire missing enamel (Hammerl 2013: 280-281). Known as hypoplasia, only one case of was present in the entire dataset. This consisted of one large pit and two smaller pits on an adult M1 (see BC-3, Appendix C and Chapter 7). The exact age at which this tooth was affected is unknown, but given that it happened during development, the dog was a very young puppy.

Supernumerary Teeth

There was only one instance of supernumerary teeth, or hyperdontia. A tiny, peg-like tooth was found between the upper right P1 and canine on a dog from Baldock (see BAL-526 in Appendix C). It was much smaller than the first premolar and peg-shaped. A rare condition, these may be caused by the continued proliferation of the dental lamina to form a third tooth germ, or disturbances during tooth development. Usually they are found at the upper P2 and P3, but have very rarely been found next to the P1 (Pavlica *et al.* 2001: 66-69).

Other Pathology

Other dental pathology included: the break of a lower P1 (most of the tooth lost, with a small fragment remaining in the alveolus), and a possible extra root on an M3.

Absent Pathology

There was no dental pathology in deciduous teeth. This is unsurprising, as many lesions (such as periodontal disease) are unlikely to affect them and also because they spend little time in the mouth. Ante-mortem tooth loss in deciduous teeth is impossible to distinguish from normal loss to make room for adult teeth. However, this does not mean that dental pathology was completely unknown in dogs before they reached adulthood; the adult dentition finish erupting at 4-6 months, well before skeletal maturity at 8-14 months (Geiger *et al.* 2016: 4). Indeed, five subadult dogs were affected by alveolar recession. This will be explored further in 6.4.

There are two types of dental pathology (noted in Vann and Thomas 2006) that were not present in the dataset. The first is tooth displacement, which may be secondary to trauma (Gracis 1998), nor were any cases of anomalous crown height present. This appears to be either very rare or unknown in canine teeth: Boy *et al.* 's review of structural tooth defects in dogs note several crown defects, but none that result in anomalous height (2016).

6.2.5. Summary: A Variable State of Health

As this section has shown, ABG pathologies are a complex issue; they can be divided into broad category, specific sub-type and whereabouts they are found on the skeleton. Many different variables can be used to comparatively analyse lesions. For this research, however, I have focused on two key differences: change from the Iron Age to the Roman period, and change prompted by urbanism.

The first step was to see how common pathology was across the skeleton. This used the five categories outlined in Chapter 3: head, trunk, limbs, paws and joints. Overall, most pathology was found on the trunk and limbs, even when this was adjusted against ABG completeness. Iron Age and Roman specimens have similar trunk pathology, but the latter has much more limb pathology. It is difficult to tell if there are any significant trends in other areas due to the small dataset, which adversely affected statistical testing. When broken down by site type, rural sites were found to have more trunk pathology.

When the general types of pathology were examined, it was clear that bone formation was the most common, followed by alteration of shape. Fractures were much less common, as was bone destruction: alteration of size was rare. Frequencies of pathology vary little between Iron Age and Roman ABGs. They do, however, vary more between Roman urban and rural sites. Within these categories, there were no specific trends for bone destruction or alteration of size; the numbers were too low. Fractures were largely oblique, as opposed to the more complex fracture types. The two most common pathology types had clear trends: periostosis and enthesophytes were most common varieties of bone formation, followed by osteophytes. Other types were rare or absent. Alteration of shape is mostly made up of limb and spinal bowing. Differences between Iron Age and Roman ABGs exist, but do not follow any clear pattern aside from different types of bowing.

Combining pathology frequency by anatomical location *and* categorical type indicated patterns similar to 6.2.2. When compared against phase, trunk pathology types *and* overall numbers were similar between the Iron Age and Roman ABGs. On the other hand, limb pathology was not only different in terms of overall prevalence, but the most common types in each phase varied somewhat. The Iron Age ABGs had a greater proportion limb fractures than the Roman ABGs, whereas the latter had far more bone formation, destruction and alteration of shape.

Dental pathology, analysed separately, showed that aside from the M1, it was evenly spread throughout the teeth. Alveolar recession was more common in mandibles than maxillae. Iron Age ABGs had higher rates of cavities, ante-mortem tooth loss and alveolar recession; these are all signs of periodontal disease and poorer dental health. Meanwhile, ABGs with congenitally absent teeth always came from Roman contexts.

Moving forward, this means that the pathology in this dataset is most representative of the trunk and limbs. Head and paw/joint pathology are uncommon. The Iron Age and Roman periods have similar types of pathology and frequencies of trunk pathology. They differ in terms of limb pathology, some sub-types (such as rates of osteophytes and bowing) and dental pathology. When Roman ABGs are divided by the type of site they come from, they show that urban and rural dogs have crucial differences in the types of lesions they had, although there are some metrics where they are similar or show only small differences. In some cases, the rural ABGs more closely resembled the ABGS from the preceding Iron Age.

In this analysis, there are some small but major trends. These include the near-absence of limb bowing in Iron Age sites and the huge difference in spinal bowing between Roman urban, and Iron Age and Roman rural sites. It is nearly unknown on urban sites, but very common on rural and Iron Age sites. The other is that fractures are low in overall number in the dataset. This contrasts with other sites in Britain where it is much more common (see Bellis 2018), although this may be due to selective recording.

Understanding *what* pathology the ABGs had is only the first step to understanding canine health. The next is to investigate *why* they developed in the first place. This will bring us closer to understanding the kinds of conditions experienced by dogs during their lifetime, and how they relate to the broader human-canine relationship.

6.3. Why Health Varied

6.3.1. Pathology and Aetiology

Two pathologies may have different features, or manifest on different parts of the skeleton, yet have the same underlying cause (known as *aetiology*). The cause of some pathology is quite obvious: a bone breaks due to trauma. Yet others are more difficult, and it is perhaps impossible to be entirely certain why they occur; many bone growths fall into this category. As there are over 300 individual lesions recorded on the ABGs, I will sort them into four broad nosological categories for comparative analysis:

- *Congenital:* present from birth (whether due to a birth defect or inherited trait). This includes non-heritable anomalies present from birth, known as structural conditions, and inherited conditions (World Health Organisation 2019). Both conditions have been included in this category; for some congenital pathology, it is not known if they are heritable or not.

- *Arthropathy:* lesions that develop throughout the animal's life due to traits such as age, size and/or bodyweight. The term refers to joint disease although in this case I also include a small number of non-joint lesions within the category that are linked to ageing.

- *Trauma:* this is usually used to refer to fractures, but may also include stress that causes bone formation or destruction.

- *Other Disease:* types of disease that do not fit the above categories. These include neoplasia, metabolic and inflammatory disease, or occur as a result of bacterial or viral infection. They may vary greatly in presentation and can be local or systemic. The disease may be cleared soon after it was contracted, or be present for the rest of the life of the animal.

The category for each lesion has been determined in conjunction with other biographic features about the animal: age, size, and the general completeness of the skeleton. For instance, a single, unilateral lesion in a well-preserved skeleton is unlikely to be caused by systemic disease. Larger dogs are more prone to develop arthropathy, particularly osteoarthritis, as are older dogs (Mele 2007). However, some cases may be definitively diagnosed, while others can only be categorised on the basis of the most likely cause. Due to the high number and range of lesions, and the lack of clinical foundation for many, in-depth differential diagnosis has not been possible for every single one within the time frame. Broad exclusionary diagnosis has been undertaken for each lesion, while complex and/or unusual cases have been selected for differential diagnosis. Although I discuss several of the latter here, the original notes are contained in Appendix E, and select lesions were photographed in Appendix C. Obviously there are sub-categories within causes, and some pathology has a degree of overlap across them. For example, did a large dog develop an issue due to its size (arthropathy) or genetic susceptibility (congenital)?

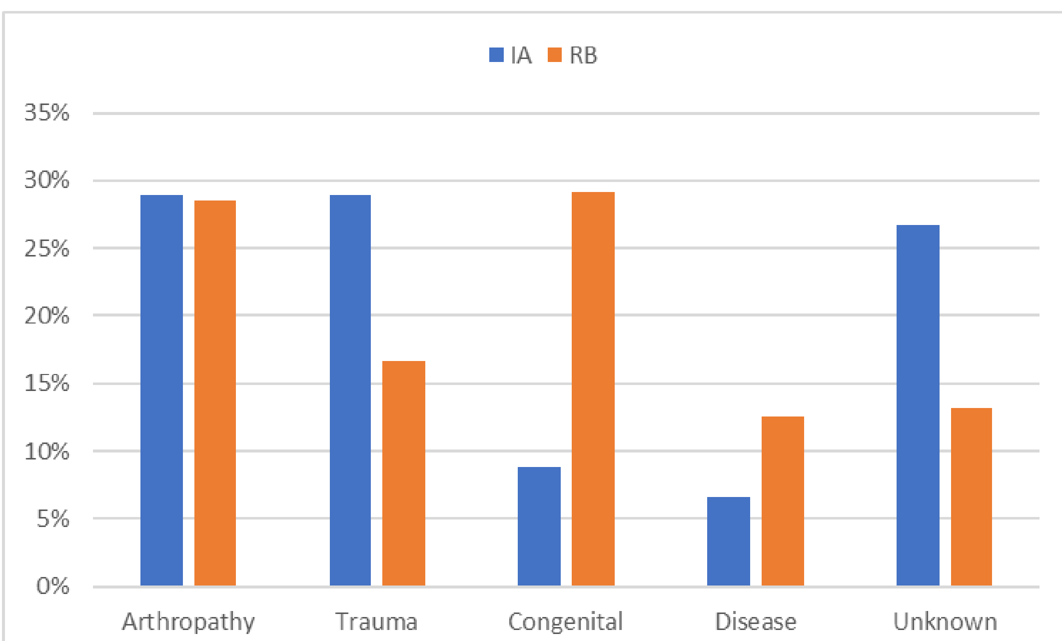

Fig. 6.36. Percentage of total lesions by aetiology, sorted by phase.

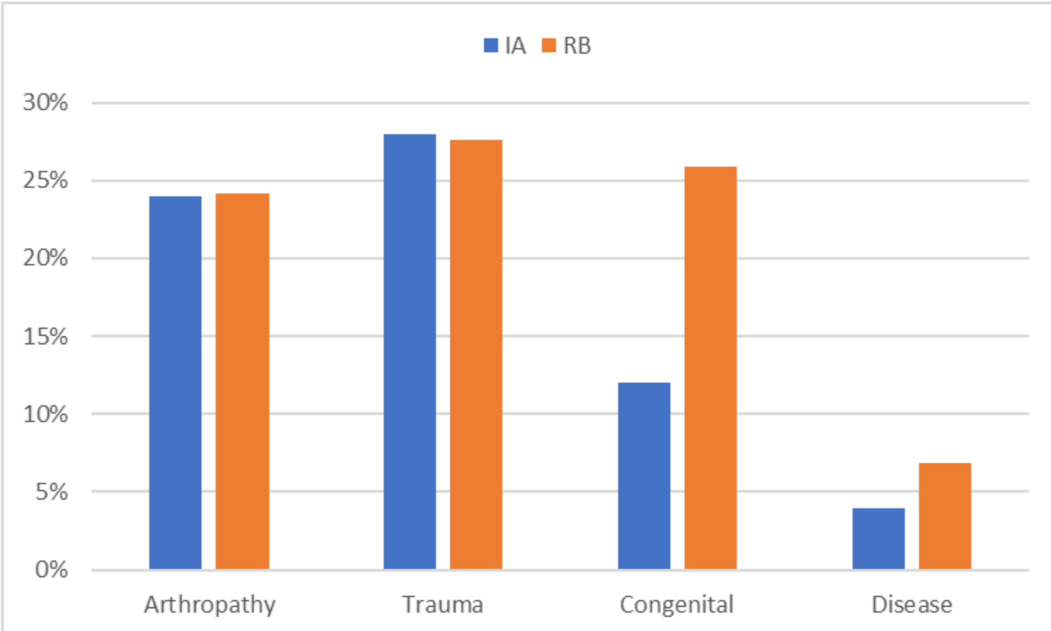

Fig. 6.37. Percentage of ABGs affected by phase.

The rates of trauma are high for both phases (see Figs. 6.36 and 6.37), with over a quarter of ABGs affected. However, this ranges from major trauma such as a fracture, to more minor trauma that was likely caused by a minor injury, muscle imbalance or strain (see below). Where the phases differ are congenital issues and disease: both have a higher prevalence in the Roman period, the former in particular.

Lesions of Uncertain Aetiology

Not all pathology was able to be diagnosed; bowing of the spinal processes make up all of the unknown lesions. This is because spinous process deviations are very difficult to diagnose. In modern dogs, they may be caused by acute trauma, be associated with other pathology, or be completely asymptomatic. Other potential causes include early-life injury that leads to asymmetrical axial muscle development, core muscle weakness (Lawler *et al.* 2016: 61-62) and low-level stresses from physical work. Taphonomic causes are unlikely, given their prevalence in living animals, as are purely genetic causes (Lawler *et al.* 2016: 60-61).

Most modern working dog injuries affect the limbs, but can also affect the trunk, in particular the iliopsoas muscle (Baltzer 2012). This attaches to most of the lumbar vertebrae and last two thoracic vertebrae (Cabon and Bolliger 2013), where most process deviations are known to occur (Lawler *et al.* 2016). It is therefore possible that the two are linked. However, there are no studies that conclusively tie this particular injury to spinal process deviation, so this must remain a possibility until more research is produced.

In the dataset, there are six (24% of ABGs) cases of process deviation in Iron Age and eight in Roman dogs (14%). In both phases, they are rarely associated with any other spinal pathology, and vary in their severity. Most are only slight deviations of about 10-15 degrees, but a few are much more dramatic, at up to 60 degrees (see Fig. 6.38). The lumbar vertebrae are most commonly affected, but a few thoracic vertebrae are (Fig. 6.39). Although it was not always possible to determine the precise place of each vertebra, due to taphonomy, most of the thoracic vertebrae were likely to be T12 or T13.

Beyond very broad speculation, it is difficult to give any confident diagnoses of spinal deviation. It is likely that, as a group, they are of mixed aetiology. Stress from carrying heavy loads is unlikely, but muscle injury (perhaps associated with working activities) is possible. It is possible that dogs sustained more muscle injuries and/or imbalances in the Iron Age. The fact that they affect medium and large animals slightly more supports this idea, as they would have a higher chance of being working animals.

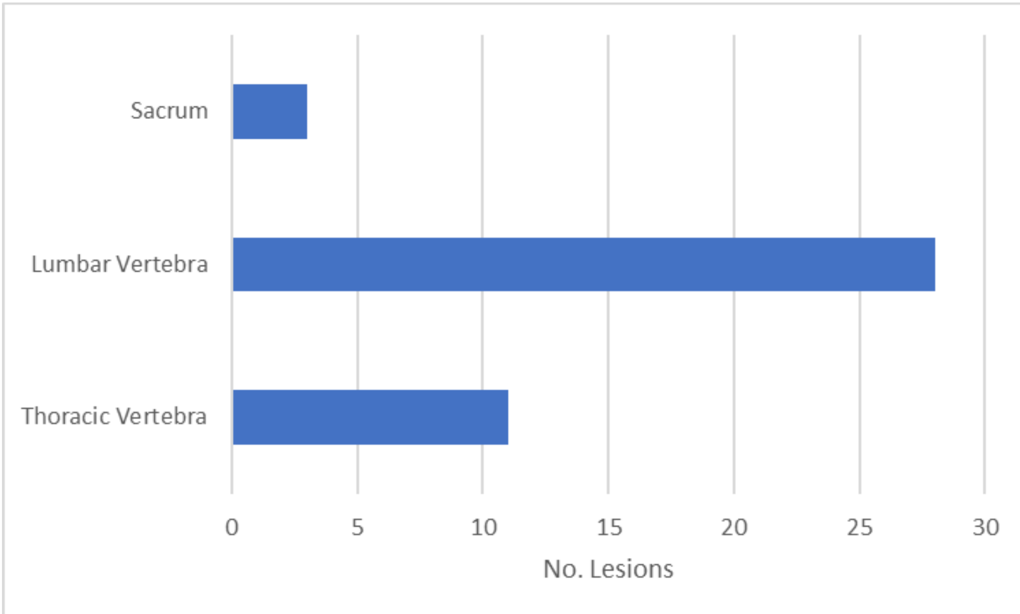

Fig. 6.38. Number of vertebrae affected by spinal process deviation, by type.

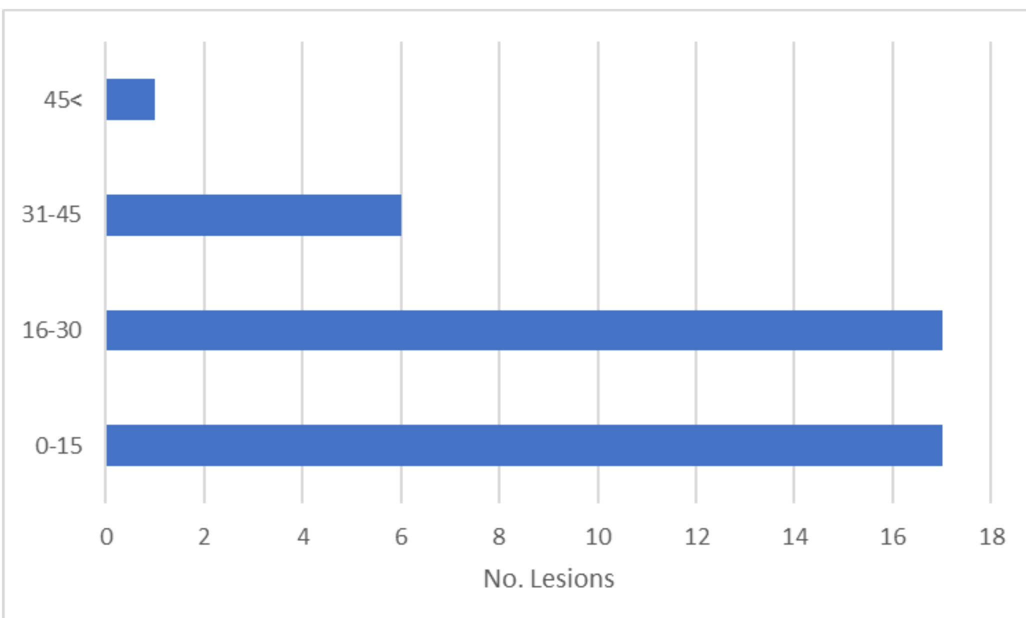

Fig. 6.39. Number of vertebrae affected by spinal process deviation, by angle of deviation.

Aetiology in Detail

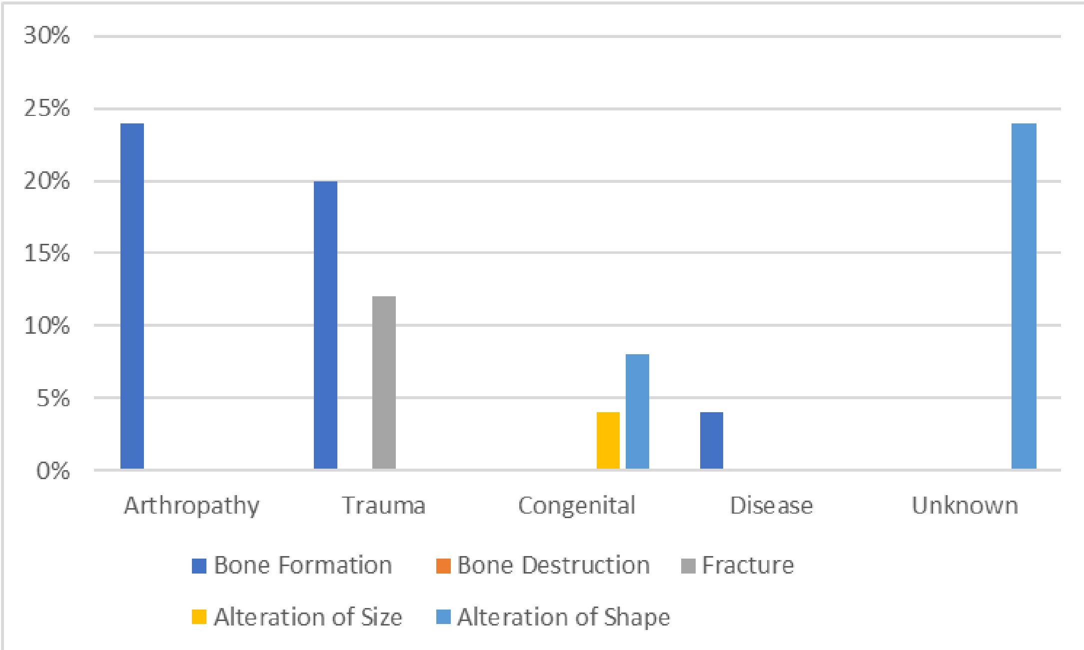

Fig. 6.40. Percentage of Iron Age ABGs with pathology, sorted by aetiology and pathology type.

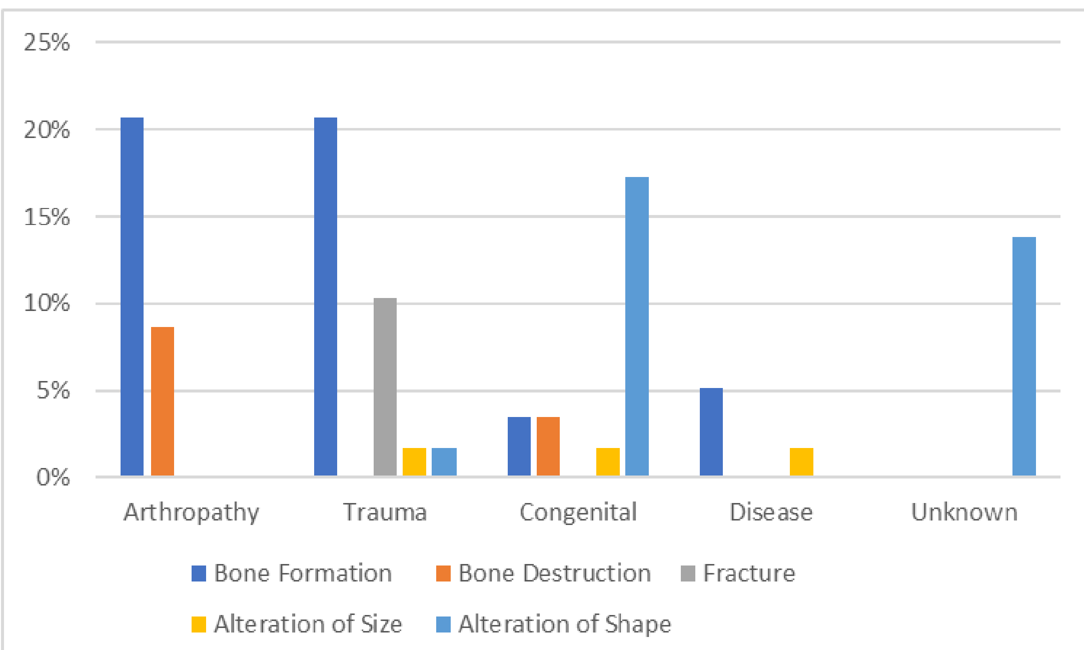

Fig. 6.41. Percentage of Roman ABGs with pathology, sorted by aetiology and pathology type.

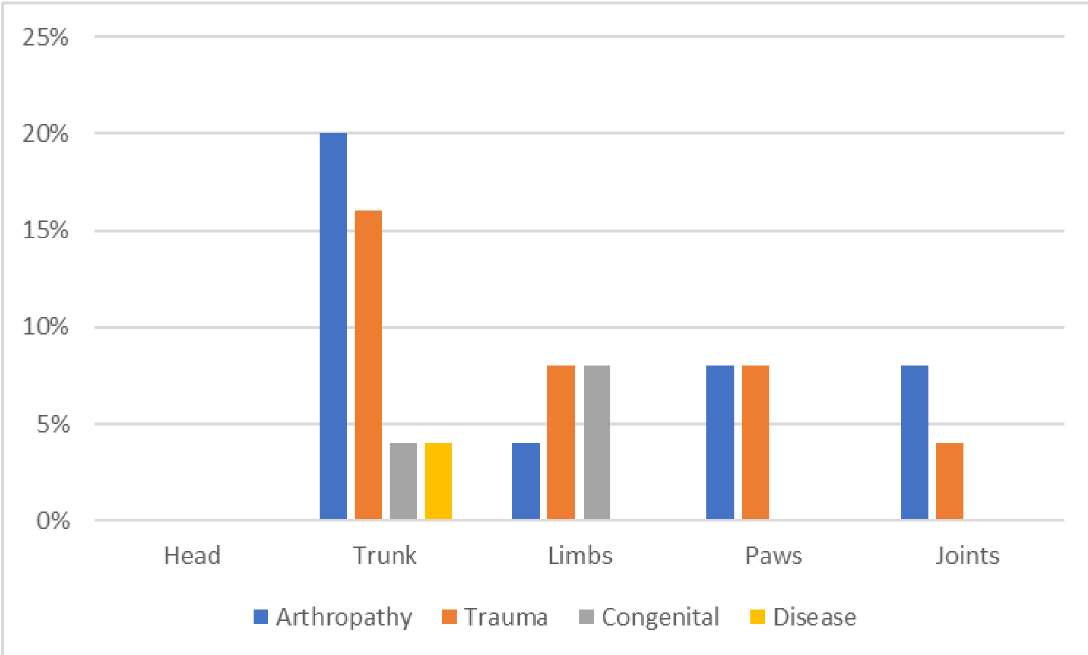

Fig. 6.42. Percentage of Iron Age ABGs with pathology, sorted by aetiology and pathology location.

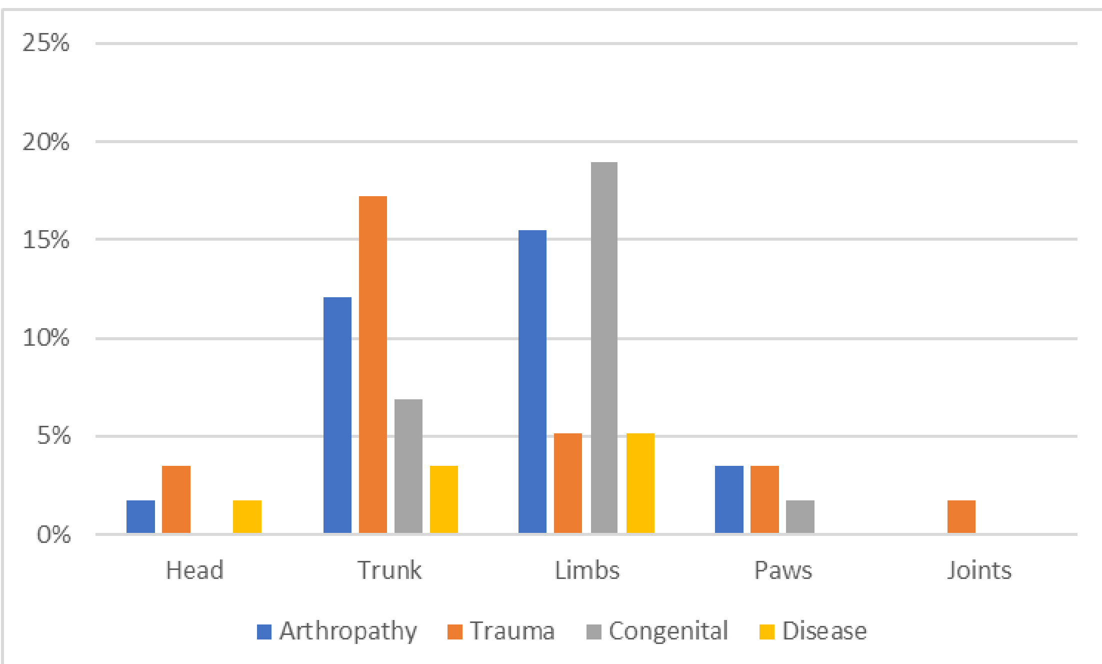

Fig. 6.43. Percentage of Roman ABGs with pathology, sorted by aetiology and pathology location.

Congenital/Inherited

Many congenital issues are easy to determine. There are two that dogs are particularly prone to: absence of teeth (usually the third molar) and bowing of limbs. On a strictly numerical basis, they are the most prevalent lesions. However, this is because a single dog with chondrodystrophy may produce up to 10 separate lesion records, if all the major limb bones are present. When the number of ABGs affected is analysed instead, then the number becomes much more representative of the sample. It is worth noting, however, that rare congenital conditions are difficult to diagnose, and may be under-represented.

The majority of congenital lesions (see Figs. 6.40-6.43) are on the trunk or limbs. While they mostly present as alteration of shape, they also caused small amounts of bone formation, destruction and enlargement of bones.

Other Disease

Disease is rare, and for good reason: many diseases leave no trace on the canine skeleton. Rabies and many other conditions can affect a dog, yet its skeleton may appear to be in perfect health. Nearly all lesions diagnosed as disease present as bone formation (see Figs. 6.40-6.44), except for two in the Roman dataset that resulted in alteration of size. It mainly affected the limbs and trunk in small numbers, but there is a case on the mandible of a Roman ABG. Three ABGs had undiagnosable disease: OW-20 and FB-1 has systemic periosteal formation across the skeleton that suggested inflammatory or metabolic disease, while OW-13 had a dramatic case of osteopetrosis (growth of bone in medullary cavity) that requires radiography or other imaging to diagnose with confidence (see Appendix E for further discussion on each).

However, two metabolic diseases could be diagnosed more confidently. The first was rickets in CA-2. The distal metaphyses of the femur and tibia were heavily swollen (see Appendices C and E for further discussion), which is a diagnostic sign (cf. Johnson *et al.* 1988). Additionally, other lesions in the dog suggest the dog may have been kept immobile for some time, perhaps indoors; vitamin D deficiency is a common cause of rickets (Dittmer and Thompson 2011). The second, enamel hypoplasia, showed pathogonomic pits in the M1 of BC-3 (see Appendix C). While the exact cause of this is not certain, beyond some kind of stress from illness or nutritional deprivation in very early life (Hammerl 2013: 280-281), the lesion itself is unmistakeable.

Arthropathy

Arthropathy is a tricky category. Unlike the first two categories, lesions caused by arthropathy and trauma have a small area of overlap. While the formation of osteophytes and joint lipping are usually caused by arthropathy, enthesophytes are slightly more complex. They are caused by stress to a ligament or tendon which is usually traumatic but may occasionally result from joint instability as a result of age (Dyson 2011: 172-173). Although bone formation around joints is a classic symptom, arthropathy may also result in bone destruction, particularly in potential cases of osteoarthritis (to be discussed further in 6.2.3). Arthropathy affected all areas of the skeleton, but the limbs and trunk most heavily.

Trauma

Some cases of trauma are obvious: fractures cannot be confused with the other categories. Periostosis and calluses were also caused by trauma. Other lesions, however, may be difficult to distinguish from arthropathy. As discussed above, most cases of enthesophyte were judged to be trauma aside from a couple that may be linked to local arthropathy. However, a couple of other lesions were linked to physical trauma: two cases of bone destruction, specifically necrosis in the vertebrae of BC-4 (see Appendix C; Appendix E for further discussion), were judged to have been likely caused by infection stemming from trauma. This is because the accompanying bone growth appears to be spondylosis deformans, a disease that arises from vertebral instability. Morgan and Biery note that instability may be caused by either degeneration of the vertebral disks from ageing or trauma (1985). Yet the condition appears far too dramatic to be the former, and no other signs of ageing are present on the skeleton.

Trauma is present on all parts of the body for Iron Age and Roman ABGs. In both instances, however, it is most common on the trunk.

Aetiology and Site Type

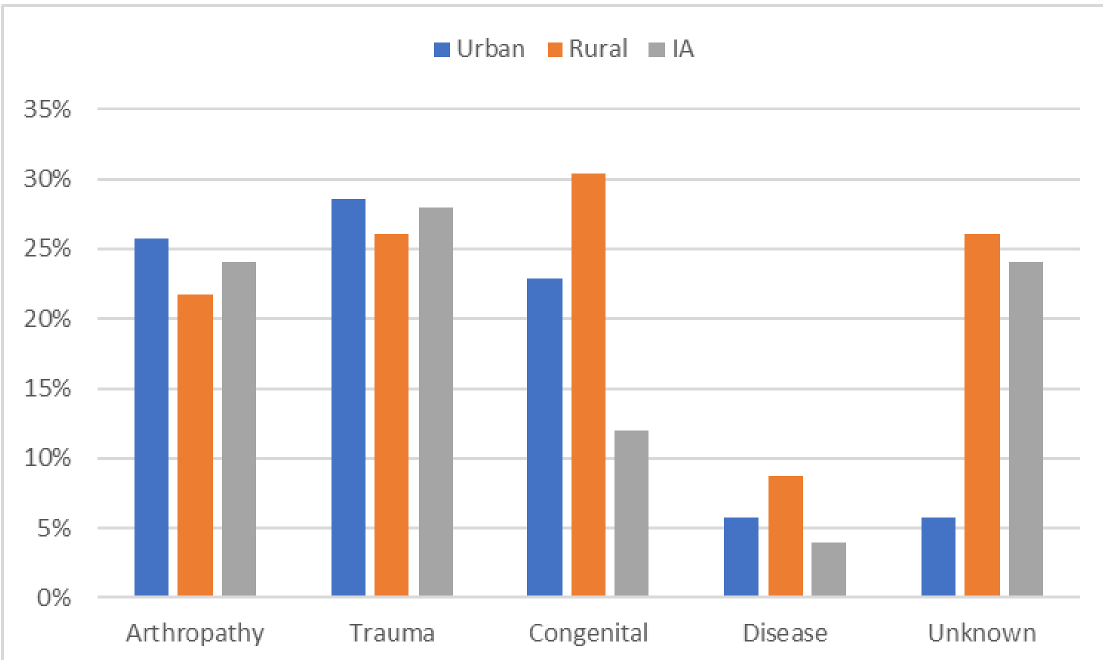

Fig. 6.44. Percentage of ABGs affected by pathology, analysed by aetiology and site type.

The difference between urban and rural sites is smaller than might be expected (particularly compared to the results in 6.2). There is little difference for arthropathy and trauma, except a very slight increase on urban sites (Fig. 6.44). Congenital pathology is moderately higher on rural sites, as is disease. However, as the rates are low for the latter, the results are less likely to be significant. The major difference is unknown pathology, which is much higher on rural sites, and reflects the rates of spinal bowing. When compared against the Iron Age, there is little difference in the rates of arthropathy and trauma. It is interesting that rates of congenital pathology are much higher for both

Roman urban and rural ABGs than Iron Age ABGs, despite the fact they differ from one another.

6.3.2. The Four Horsemen of Pathology

We now have a good idea of how the pathology in this dataset was caused, and how much each general category occurred in the dogs. Each of the four aetiologies, however, has deeper significance than simply lines on a chart; it may show how dogs' lives, and their interactions with humans, played out.

Trauma and a Working Dog's Life

Studying working injuries in dogs is difficult. This is because, relative to horses and cattle, there are few clear markers that they happened while working. Because horses were ridden directly and used for traction by humans, often using specialist equipment, some equipment (e.g. bits) may show direct skeletal markers. This use also adds extra biomechanical demands, which may put them at greater risk of spinal fusion (Bartosiewicz and Gál 2013: 136-137). The use of cattle for repetitive traction shows markers from pulling a heavy plough on a regular basis (Thomas *et al.* forthcoming). Dogs in artistic and textual evidence (cf. 5.3) however, were depicted performing the majority of their work without equipment that would leave skeletal marks. The nature of the work may not cause sufficient strain to be apparent on the skeleton, relative to less active dogs. If a dog sustains a fracture, did it happen during working activity, or accidental or non-accidental injury outside of it? As a result, there has been comparatively little study on working injuries in dogs. Armour-Chelu and Clutton-Brock have made brief mention of shoulder arthritis in sled-dogs (1985: 298) while Bartosiewicz notes that modern sled-dogs are highly prone to arthritis as a result of repetitive strain injury to the joints (2013: 143). This is interesting, but is of less use when looking at populations that were unlikely to pull sleds on a regular basis; no known textual sources have been found that refer to the Romans using dogs to pull sleds, nor has archaeological evidence been found (throughout Chapter 2) to suggest that Iron Age Britons or Romans engaged in this practice. While we cannot be completely certain that dogs never pulled or bore loads, the evidence points to the majority of work activities being related to hunting and guarding (see 7.3 for further discussion), especially given that cattle and horses were readily available to carry loads and people. Evidence for the use of dogs for in war is scarce and there are few sources that discuss the use of dogs in fights. What few sources exist pertain to their use in the arena only, mainly to assist *venatores* in fighting game animals (Junkelmann 2000: 73).

Hunting and guarding are, indeed, risky activities in themselves. Hunted animals may be as diminutive as a hare or fox, or as a formidable an adversary as a boar or stag. Threats to dogs while guarding property and livestock included wolves and people. The number of wolves in Iron Age and Roman Britain is difficult to quantify, but they were found in small amounts during the Roman occupation (King 1999a: 146). Textual sources also discuss the risk that wolves pose to sheep flocks (Columella *Rust.* 7.3-4; Varro *Rust.* 2.2-3), suggesting this was a common concern in mainland Europe at least.

Most of these risks would result in direct trauma, although they may also lead to severe arthropathy down the line (Dyson 2011: 172-173). This means that, if some arthropathy accompanies a healed injury, the two may be linked. The likelihood of repetitive strain injury is probably low in guard dogs, given the fairly inactive nature of the role. It is more likely to occur in hunting animals, but is still a fairly low possibility. It could be argued that this is an activity much more similar to the behaviour of their wild progenitors, than an activity such as sled pulling.

However, despite this, the overall frequency of trauma affects a quarter of ABGs on average. This occurs even though major trauma (such as fractures) is not common. This suggests that many dogs sustained minor injuries from either minor traumatic events, muscle strains or injury. It is exceptionally difficult to contextualise. Perhaps this happened because dogs were very physically active, and accrued small injuries and strains during works. Perhaps common mishandling and mistreatment happened to dogs. Or perhaps these lesions would have occurred in a fairly inactive, well-cared for population. Because we have no comparative datasets from known populations, it is very difficult to give conclusive answers. Even when major trauma does occur, it is difficult to diagnose the exact cause.

Take OW-7, who displayed a clear fracture on the snout (cf. Appendix C). This is highly unlikely to be an accident, given its location and frequency as an area for an intentional hit using an implement (Munro and Munro 2008: 31). But we don't know the context of the injury, or why it happened. So it may be a straightforward case of abuse, but as Murphy (2006: 20) notes, it may have been self-defence against an aggressive dog. There is another possibility: the dog was assaulted by an animal, or person other than its owner, during working activities. A deer or horse may have kicked the dog: modern video footage shows that even a doe may do serious damage to dogs when she views them as a threat to her young.

Thus, trying to work out the exact cause for each lesion is near-impossible. However, it is possible to look at general trends in a dataset. Trauma to the limbs and paws is much less likely to be caused by abuse than injury to the head or trunk: most abuse is the result of blows to the head and trunk from above, or kicks to the ribs from below (Munro and Munro 2008: 31-41). Thus, if one dataset shows more head and trunk traumatic injuries relative to another, this may suggest a higher rate of abuse. This does not mean that all of the head and trunk injuries were caused by abuse, but that is it much more likely to happen than a matching dataset where all of the injuries were due to limb breakages. This general rule can be used to compare traumatic lesion prevalence through time and space. Trunk trauma is higher in the Iron Age and Roman ABGs, but only by a small amount. Nor is the rate significantly different between Roman urban and rural sites. This suggests that rates of abuse stayed fairly constant in this population throughout both phases, and with the rise of urbanism.

What (Congenitally) Small Teeth You Have...

Congenital traits may be inherited from a parent, or occur as a spontaneous mutation. When they persist in a population, this may suggest they were the intentional or accidental outcome of selective breeding. Many congenital issues have spontaneous occurrences that cannot be passed on (or may occur as a by-product of other issues), but there are several key conditions that can be passed from parent to child (Donnai 2001: 448-449). The first, and most striking, is the shortening and twisting of the limb bones, known as chondrodystrophy. Canines affected by this condition may be identified by thick, bowed limbs. This affected only one Iron Age ABG, but eight Roman specimens. While limb bowing may also be caused by rickets and trauma (see paper), both issues are highly unlikely in these cases. The bowing affected multiple limbs, were of similar shape (see Appendix C for range of dog limb bones), and was not accompanied by the metaphyseal swelling that characterises rickets.

It is debatable whether general small size is sufficient to be counted as a congenital condition. Certainly it is inherited, and is associated with the same variant of insulin-like growth factor 1 (IGF1) gene (which regulates skeletal size), but Rimbault *et al.* 's study suggests that this mutation is also found in larger breeds and that multiple genes may be responsible for small size (Rimbault *et al.* 2013: 1985-87). For purposes of this study, only bowed limbs have been regarded as a congenital issue. Interestingly, this was present not only in small dogs of <35cm, but one dog from Owslebury with a withers height of 39cm.

Several other types of congenital lesion were identified, including unusual bilateral growths and grooves that did not appear to be caused by arthropathy or trauma (see OW-1 in Appendices C and E. No clinical literature may be found, but it is potentially a benign but unusual physical feature that was either inherited or caused by a very minor growth issue at birth. Another was loss of subchondral bone which is noted by Lenehan and Sickle to have a hereditary component (1985). These congenital issues are near-exclusively present in the Roman specimens, which is particularly interesting, and may be suggestive of greater genetic diversity in the ABGs from this phase.

The Ageing Process

Arthropathy is a complex and wide-ranging category, covering many different sub-types of lesion. These are (usually) caused by skeletal stress accumulated over life, or from a greater degree of bodyweight. Osteoarthritis is the best-known example, and has had the most attention devoted to it in palaeopathological literature (e.g. Bartosiewicz and Gál 2003: 105-106). It can be rather exciting to find the more reliable markers, such as eburnation: two dogs, BAL 485-4 and FB-1, had cases of this (see Appendix C). This is caused by the degeneration of cartilage, which lead to the epiphyses grinding together to produce a smooth, glossy polish on the articular surface of the bone. However, one marker alone is not enough to diagnose osteoarthritis. Baker and Brothwell's criteria specify that an animal needs three of the following:

1) Grooving on the articular surface.
2) Polish on the articular surface of the bone, known as eburnation.
3) Lipping of the articular surface.
4) Growth around the articular surface of the bone.

(from Baker and Brothwell 1980: 115)

This means that several of the dogs in this assemblage had precursors of arthritis, but it was not possible to diagnose the full-blown condition. They may have suffered from degenerative joint disease in life, but some of the signs may be absent from the ABG due to preservation. There are other conditions that older and larger dogs are predisposed to. These are particularly likely to occur in the vertebrae and pelvis.

Some arthropathy may not even be caused by biomechanical stress at all: it may rarely be caused by infection or as an autoimmune disorder in dogs (Bennett and Taylor 1988; Bennett 1987). Several lesions may possibly fall into this category: GY-1 had osteophytes despite being a fairly young dog. Perhaps propensity to arthropathy is inherited, or more likely to happen in conjunction with certain traits such as chondrodystrophy.

Other Types of Disease

Most disease is archaeologically invisible: the most common diseases in modern dogs do not affect the skeleton at all, with the exception of cancer. These diseases range from non-fatal, such as ringworm, to extremely dangerous, such as rabies. Rabies was present in the Middle East at least 4000 years ago (Adamson 1977: 141), and was later noted in classical texts as a common worry (e.g. Grattius *Cyn.* 383-93). There is a high likelihood of the disease's presence in Britain, given that it is spread by small animals that can cross the channel, such as bats. Overall, the snapshot of disease that faunal material provides is very limited indeed. Neoplasia is missing entirely from the dataset.

The only metabolic diseases that were visible in the postcranial skeleton was rickets in CA-2 and enamel hypoplasia in BC-3 (see Appendix C for photographs; Appendix E). A localised inflammatory issue was found in the rib area of OW-11 (Appendix E). As noted earlier, several ABGs likely suffered from undiagnosable disease, for which the full data may be found in Appendix E. This is a very small range, and it is almost certain that the true prevalence of other types of disease is vastly under-represented. However, there is one anatomical area that is very vulnerable: the mandibles and maxilla. Periodontal disease frequently affects the underlying bone, and can cause cavities, porosity, and recession. A high number of dogs showed some signs of periodontal disease of some variety, indicating this was a common dental issue.

6.3.3. Summary: What Pathology Says About Life

After looking at pathologies found on the ABGs, we now have a fairly good impression of why these lesions developed. On the whole, arthropathy and trauma are the most common types. Congenital issues are as common as trauma and arthropathy on Roman ABGs, but uncommon on their Iron Age counterparts. The diversity within each category varies somewhat. Most congenital lesions are limb bowing caused by chondrodystrophy and disease represents only a few conditions, whereas trauma and arthropathy vary greatly in location, type, and severity. Other types of disease, particularly metabolic and inflammatory are very rare, while neoplasms are absent. This may be due to both their rarity and difficulty in identifying, and may not show the true prevalence.

There is only a small overall difference through time. Arthropathy and trauma rates are very similar, even when Roman ABGs are divided into urban and rural categories. Congenital disorders are higher across the board in the Roman dataset, regardless of site type. When examined in detail, pathology types and aetiology are very similar for Iron Age and Roman sites, aside from more alteration of shape on Roman ABGs. Trunk pathology has a higher rate of arthropathy for Iron Age, but higher rate of congenital pathology for Roman dogs. This trend is similar for the limbs.

Interpreting these aetiologies is the most challenging step thus far. There is considerable variation for *why* they occurred, even within the same category. A traumatic lesion may be caused by accidents from heavy physical activity, human abuse, animal aggression, and even small-scale muscle tears or strains. It is clear that looking at whole populations gives a broad indication of canine health and welfare, but cannot give the most precise insights into human-canine relationships. We will need to look at each dog as an individual animal to do that.

6.4. What Affected Health: Comparative Analysis

Sections 6.2. and 6.3. analysed pathology in detail: where and how it occurred, and why. Yet other aspects of the canine biography may affect health; its size, pre-burial treatment and diet. Individual biographies (as detailed in Appendix A and Chapter 7) are excellent for drawing out individual cases where this has happened, but are less useful for showing if these are part of a wider trend or a singular case. Here, I will cross-compare different aspects of the ABGs to draw out any patterns that may be present.

All Dogs Great and Small

(Size/Shape vs Health)

Most of this chapter has been dedicated to pathology between phases and different types of site. What if the basic physiology of the dog was also a factor? Size in particular may affect pathology, with larger animals being more prone to arthropathy and osteosarcoma (Baker and Brothwell 1985; Mele 2007). Smaller dogs may suffer from congenital issues, such as dental problems (Bellis 2018; MacKinnon and Belanger 2006). For purposes of this study, Clark's size categories will be used: <35cm shoulder height for small dogs, 35-50cm for medium and >50cm for large dogs (1995).

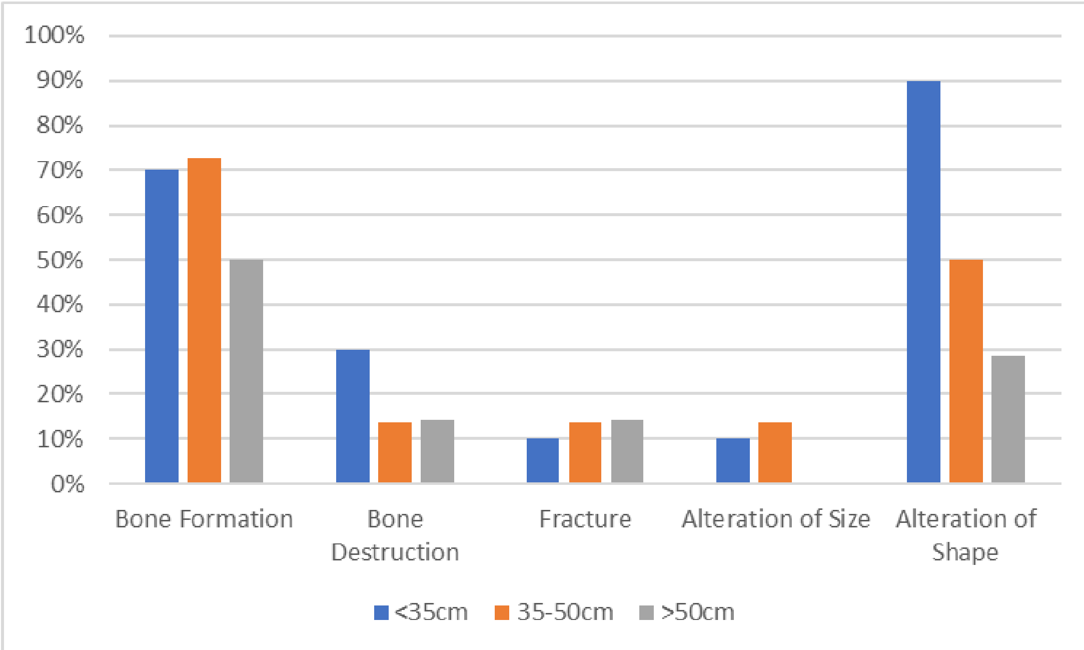

Fig. 6.45. Percentage of ABGs affected by main pathology types, sorted by size category.

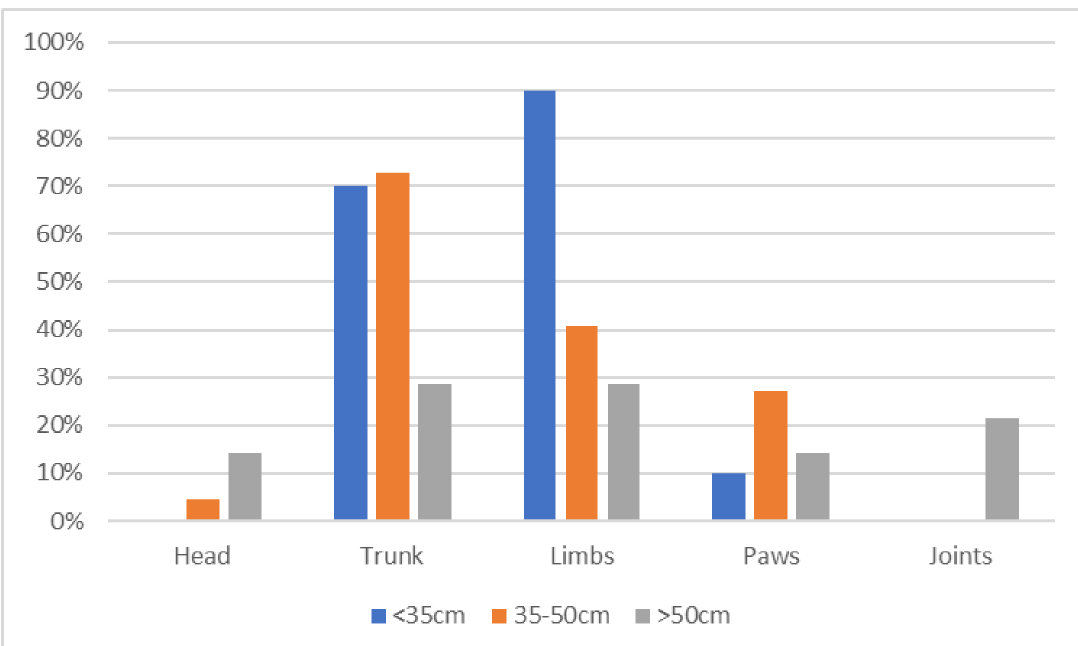

Fig. 6.46. Percentage of ABGs affected by pathology at anatomical location, sorted by size category.

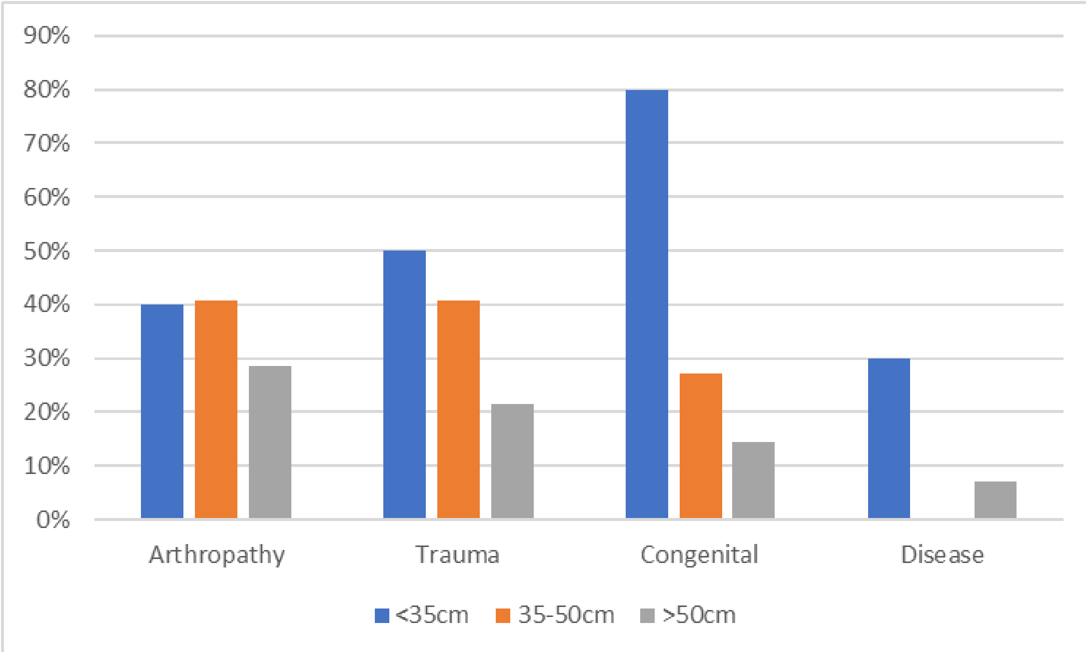

Fig. 6.47. Percentage of ABGs affected by pathology, sorted by aetiology and size category.

Comparative analysis shows that bone formation and arthropathy are less common in large dogs, despite the fact their greater bodyweight would usually be expected to predispose them. They also have much less pathology in the trunk and limbs, and less pathology in all four aetiology categories (Figs. 6.45-6.47). On the other hand, smaller dogs have more alteration of shape, limb and congenital pathology; this is congruent with other studies (Bellis 2018; MacKinnon 2012). They also have more disease, and slightly higher rates of trauma. Medium-sized dogs present an interesting case: they have much less congenital and limb pathology than small dogs, slightly less trauma and paw more lesions, but they otherwise have similar rates.

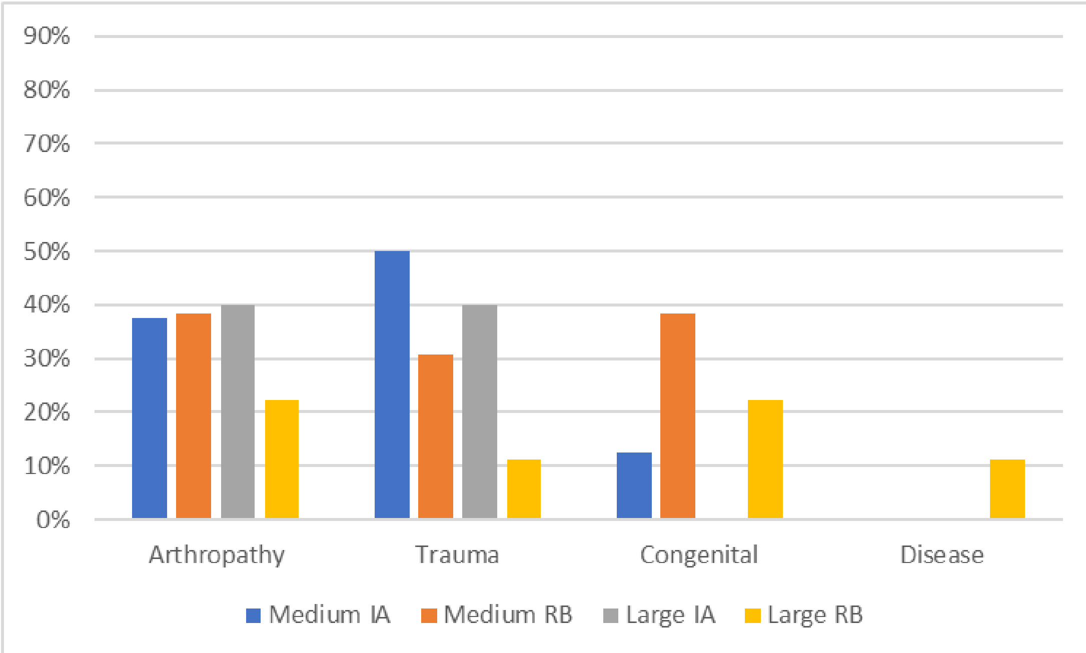

Fig. 6.48. Percentage of ABGs affected by pathology, sorted by aetiology, size category and phase.

Small dogs almost exclusively date from the Roman period, but the other two categories were divided fairly evenly between Iron Age and Roman ABGs (Fig. 6.48). Medium-sized Roman dogs have less trauma, but more congenital conditions than their Iron Age counterparts. The trend for less pathology in larger dogs actually appears to apply only to Roman specimens; the rates of arthropathy and trauma in Iron Age ABGs are similar to other dogs. However, it is important to be cautious with these results; the sample sizes are small at 10 small dogs, 22 medium and 14 large ABGs in total. The total for medium and large dogs is divided even further between phases, and even a difference of one more or less ABG with a given pathology type will heavily affect the results. Thus, while the possibility of Roman dogs suffering from less trauma is intriguing, it needs more work to ascertain.

Canine Lifeways

(Comparing Inherited, vs developing and incidental pathology)

While we have looked at health as a population, it is still not known how different aspects of health affected one another. For this purpose, the aetiologies established in 6.3. are helpful. Congenital pathology, occurring at birth, would have been present throughout the animal's life. From here, it may have influenced the rate of secondary pathology, such as arthropathy, and incidental pathology, such as trauma and disease. The main congenital pathologies are bowing and dental crowding and tooth absence.

But when the rates of ABGs each pathology type are analysed, there is only one notable result (see Fig. 6.49). 50% of ABGs with lifelong pathology have some kind of incidental pathology, suggesting that they may predispose the affected dog to disease and/or trauma. But otherwise, the rates are fairly similar, at 25-33%. As these are similar to the overall rates of pathology outlined in 6.3, it cannot be said that lifelong pathology predisposes dogs to developing lesions, and that developing and incidental pathology do not increase the likelihood of dogs developing another type of pathology.

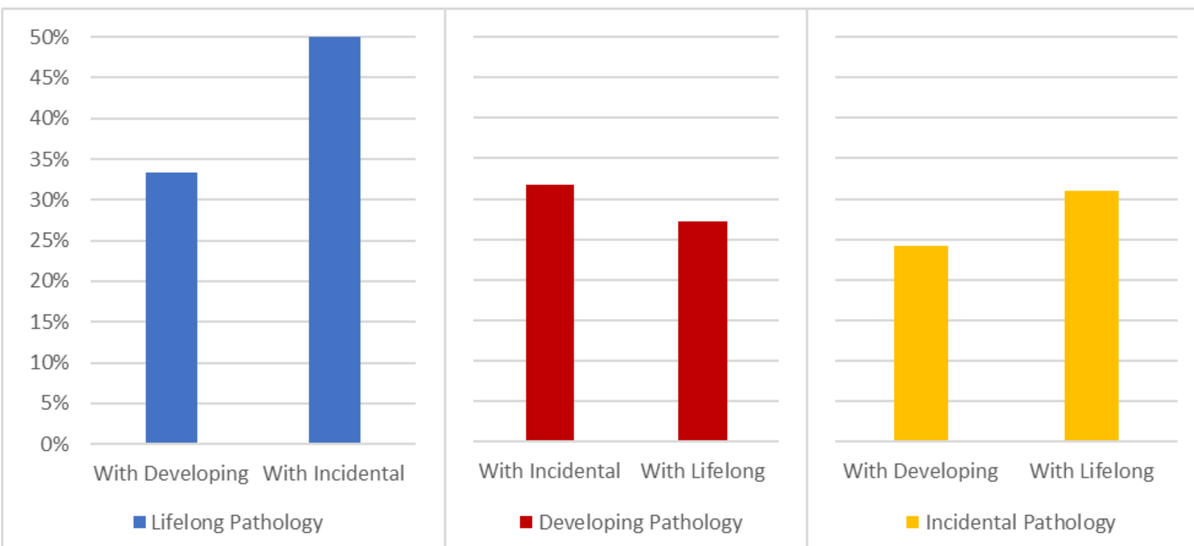

Fig. 6.49. Percentages of ABGs with more than one type of pathology, sorted by first pathology type.

Bringing out the link between pathology and other ABG characteristics shows a few interesting, albeit curious results. Large Roman dogs in particular are less afflicted by pathology, and smaller ones have much more limb and congenital lesions. It is possible that congenital, or lifelong pathology, may predispose dogs to suffering from disease or trauma. However, the major issue with all of the above analyses is their small sample sizes: many dogs, particularly subadult dogs, were not able to be measured for size.

The Matters of Burial

(Butchery and gnawing vs size and health, deposition context vs size and health)

An intriguing question is whether the way a dog was treated after death reflects its treatment in life. A few ABGs were butchered (to a greater or lesser degree), and some had gnawing marks from scavengers. The latter suggests that they were not buried straight after death, but that the body was left out or placed in an open midden or pit.

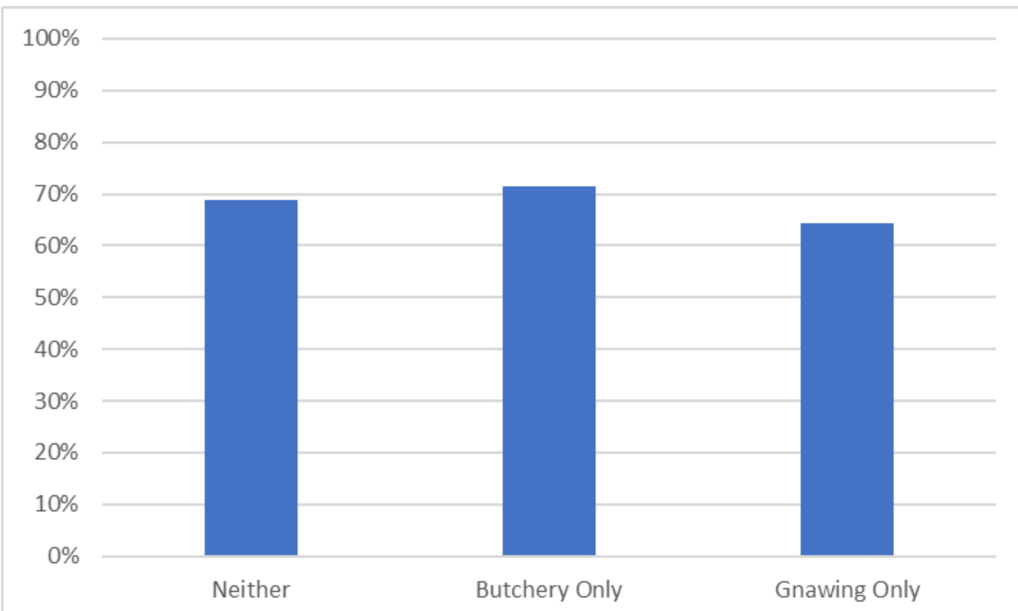

Fig. 6.50. Percentage of ABGs with pathology, by pre-death treatment.

However, there is little correlation between either of these and pathology (see Fig. 6.50). ABGs with butchery and gnawing were not included, as only 2 individuals met this criteria. Where the dog was buried may instead have some bearing on lesions found on them, especially if they were deposited in different places for distinct reasons, such as rituals or human attitudes towards the dog. As sample sizes are small for many context types, only the main Roman groups are compared.

The results suggest a possible but uncertain difference between context types (Fig 6.51). Aside from cess pits, even the largest contexts have only six ABGs or less, and no significant difference (using Fisher's test) at a p-value of 0.21. The only likely conclusion I can make is that there are no dramatic differences between the larger contexts; for instance, only perfectly healthy or young dogs were buried in wells, so differences in the dogs chosen for each much be small. However, other key features might be different: the most obvious being the size of the dogs. A quantitative analysis is impossible, given that size is unknown for many of the ABGs. A brief review indicates that small dogs were found in ditches, cess pits and wells, as were large and medium dogs. Thus, size was an unlikely factor in where a dog was deposited.

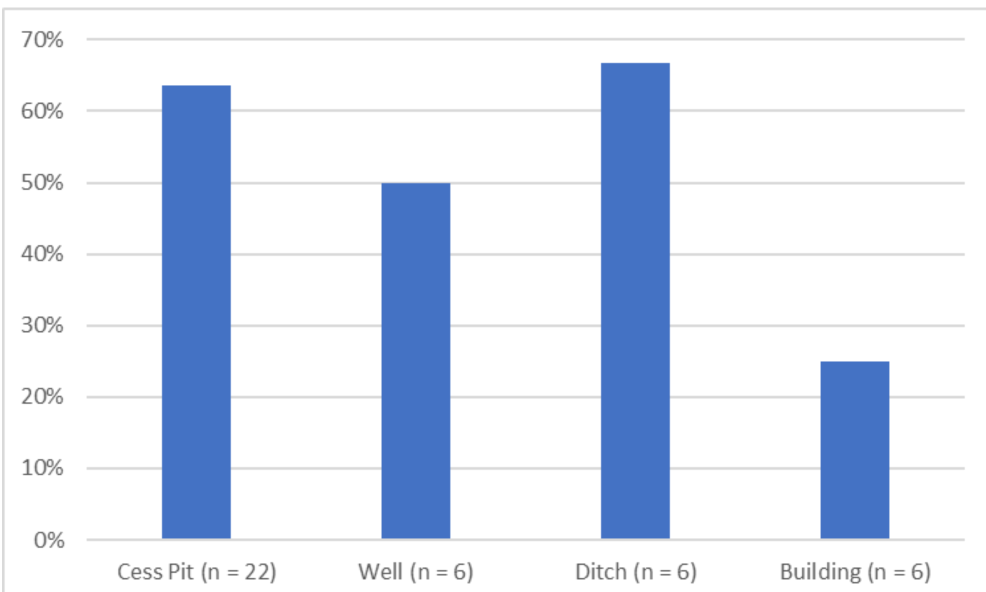

Fig. 6.51. Percentage of ABGs with pathology, by main deposition contexts.

6.5. Till Death Do Us Part

This chapter has produced an array of results, on many aspects of pathology and health. Sometimes they highlight major differences in one area or another, sometimes they show more minor changes and sometimes they show no discernible difference at all. The final interpretation of these results will be the job of the upcoming chapters. It is, however, worth recapping them here, and beginning to think about how they could inter-relate.

To begin with, we revisited the state of the ABGs. Many were incomplete, some extremely incomplete, and all had at least some bones missing. The skull, paws and joints were particularly under-represented, making attempts to work out pathology in these areas more difficult. After this, we looked at the general types of pathology that were recorded. Bone formation is the most common type by far, covering a diverse range of lesions from osteophytes to ankylosis. Alteration of shape was fairly common, but was almost exclusively due to bowing. Fractures were low, much lower than might be expected, and other types were rare. This trend was similar between the Iron Age and Roman ABGs; where variation occurred between the two phases is in the parts of the body they were found. The former had more trunk, and the latter more limb pathology; however, on closer examination urban dogs have much less trunk pathology than Roman rural, which actually has a rate similar to the Iron Age.

The next step of the process was to consider the underlying cause of lesions. Generally, pathology across the board was characterised by high rates of arthropathy and trauma, but no full-blown arthritis and fractures. So although the rates are high, many cases appeared to be minor. Disease rates are low, but very unlikely to represent the true rate of disease in dogs. The overall trends suggest that canine pathology, and thus their general state of health, did not show major variation between the Iron Age and Roman transition. One exception is congenital pathology, which sees a dramatic increase through time. There is, however, some notable difference between the Roman urban and rural sites. The most striking, and potentially most interesting, is the huge difference in the rates of spinal process bowing. It is nearly unknown in urban canines, but very prevalent in both rural and Iron Age animals.

The frequency of pathology may be comparatively higher or lower than earlier prehistory or later medieval and early modern datasets, or have scarcely changed at all. It is, however, exceedingly difficult to quantify the results relative to other dog populations. Nearly all other studies of dog palaeopathology select a specific type of pathology to examine, and/or quantify results as a proportion of NISP, not ABGs. Studies that do analyse ABGs in more detail almost always examine only a single ABG of interest (e.g. Binois *et al.* 2013; Tourigny *et al.* 2015), which may not be typical of the wider population it hails from.

This is a particular problem in medieval and early modern datasets. Grimm (2008: 57), Murphy (2005) and Teegen (2005) all rightly note the prevalence of dog rib and vertebral fractures, and suspect many of these cases may be linked to animal abuse. If true, this may suggest a rise in abuse of dogs in the medieval and early modern periods, suggesting a worsening of human attitudes. But it is impossible to ascertain this. The studies cannot be compared directly to this dataset, given their lack of ABG quantification and broad recording of pathology. This paucity of evidence for the medieval period, particularly in England, has been noted by other authors (O'Connor 2017: 221). The only study of this time period to quantify pathology by *multiple* ABGs, Baron's study of horse and dog burials, analyses an intriguing but small series of burials and only three dogs were present (Baron 2018: 117). The only other studies to examine a wider number of ABGs in the ancient world either suffer from a lack of quantification (MacKinnon 2010b) or still analyse small populations (five dog ABGs in Hourani 2018).

Next, I will pull all the evidence together to create individual biographies. Some texts and theoretical work on humans and animals will play a supporting role in exploring the dog as a (once) living being, not just a collection of bones. This will meet two of the main aims outlined in 1.3: to create animal biographies, and to use them to understand changes in canine health and welfare.

Chapter 7: The Dog's Life

The previous chapters gave a comprehensive view of how dogs varied across Britain, both numerically and morphologically. Chapter 6 even offered some insight into the life of the dog ABGs, through the types of disease (or lack thereof) each suffered from. However, this is only a small part of a dog's existence. What is missing are the other key parts of life: the kinds of roles they played in human society, and how they moved to, from and across Britain. These are all essential components of human-dog relationships, interactions and ultimately canine biographies. All of these are key project aims.

We are fortunate to have numerous references to dogs in ancient texts, in a wide variety of genres. Much of this evidence falls into two major groups: those concerning dogs and trade with Britain (both pre- and post-Conquest), and those discussing dog roles in Roman society. However, just because dogs were written about by elite authors from mainland Europe, does not mean that their cultural attitudes were imported to Britain and adopted in a wholescale manner. Conversely, it may be assumed that Roman texts were of complete irrelevance to a province as far-flung as Britain. Yet the process of studying key texts, in conjunction with faunal analysis and thematic works on Britain's assimilation into the Roman Empire, may reveal a more complex picture than either of these. Where the texts may be of particular help is placing the bone evidence within the wide cultural context of Rome. Do we see changes because of Rome? Are they adoption of wider Roman practice, unique practices, or a mix of the two?

Thus, exploring the dog's life will take two forms. Their roles and movements are to be largely gleaned from texts, and critically analysing their relevance to Britain. A small amount of faunal evidence will assist in linking the texts to the province. However, this approach still investigates dogs only as a group; creating biographies of each canine will be the second step in the process. Individual dog lives can show both the types, and ranges, of relationships between a single human and dog. By stretching the creation of biographies, from simple summaries through to a select number of comprehensive stories, we can finally begin to understand how humans and dogs interacted with one another.

7.1. The Roman Dog Trade

How are the fluctuations in dog numbers and morphology, noted in Chapter 4, linked to wider interactions between Britain and the Roman Empire? Exchange between the two were taking place long before the invasion of AD 43. While the classical texts about the British Isles are lacking in detail, and the few interactions noted are very difficult to judge, there is enough material to complement the archaeological evidence. Surprisingly, many of these references concern dogs. Trade between some British confederations and the Roman Empire was common in the Late Iron Age. The Greek geographer Strabo, writing at approximately 7 BC - AD 21/23-24 (Jones 1917: xxviii), notes that Britain was a source of unmanufactured goods, notably: 'grain, cattle, gold, silver, and iron… also hides, and slaves, and dogs that are by nature suited to the purposes of the chase' (*Geog*. 4.5.2). The exact date he wrote his *Geography* is still somewhat contested: the latest date, 24 AD, is due to his reference to the death of the Mauretanian king Juba as a recent event in Book 17. It is perhaps safer to place the quote in the later part of this range, as it is likely Strabo did most of his composition from 18-24 AD, on the basis of notes he had made earlier in his life (Dueck 1999: 467, 477-478). This list does not appear to be a fanciful or idealised one: many of the other trade goods noted were known to be either exported from Britain and/or procured by the Romans after the Conquest (Mattingly 2006: 294, 501); mines were established in England and Wales to extract and refine many different metals e.g. lead (McFarlane *et al.* 2014: 438) and iron (Taylor 2007: 36-37).

Another early, perhaps more informative, source on the trade of dogs is Grattius' hexameter poem, the *Cynegetica*. A large portion of the poem is dedicated to describing 22 dogs from various parts of the world, their distinguishing features, and their strengths and weaknesses. This goes as far as the edges of the known world, including India, but has an interesting quote about Britain: 'What if you… choose to penetrate even among the Britons? O how great your reward, how great your gain beyond any outlays! If you are not bent on looks and deceptive graces (this is the one defect of the British whelps), at any rate when serious work has come, when bravery must be shown, and the impetuous War-god calls in the utmost hazard, then you could not admire the renowned Molossians so much' (Grattius *Cyn*. 36-37). This was likely written between 19 BC and 8 AD (Fanti 2018: 61). Taken together, these sources indicate that the British-Continental trade of dogs was well established by the beginning of the first century AD. The fact that the trade of dogs is referenced in two, very different sources, is stronger evidence than one source alone. This does not necessarily mean that Grattius' description of the dogs come from personal experience or are even particularly accurate. They may have come from other Hellenistic scientists, whose works have been lost (see Stewart 2013 for a list of lost Hellenistic agricultural scientists). It is also likely that the descriptions hark back to literary tropes, employed for a fairly different purpose. The dogs listed span areas that recently opened to the Romans for trade, thanks to the Pax Augusta, and thus are connected to imperial ambitions (Green 2018: 164-65). Yet despite these literary purposes, the poem indicates an elite keenness to acquire animals from across the world to breed.

Overall, as trade was known to occur for other goods between Britain and the Continent during this time, and that the Romans and Greeks showed great interest in dogs across the known world, it is not a particularly great leap to infer that they were also trading in dogs. Archaeological evidence indicates that trade relations, between parts of Britain and the Continent, were taking place as early as the second century BC: this included a high amount of gold and small quantities of amphorae (Creighton 2000: 9-10). Yet this was unlikely to be with the Roman Republic directly, but with Gaul. Caesar's invasion of Gaul in the mid-1st century BC led to direct trade between Britain and Rome (Cunliffe 2005: 127). However, the texts do not indicate that the trade was two-way: Strabo and Grattius both refer to the export of dogs from Britain, but not the other way around. Nor do any later texts discuss this. However, the archaeology indicates that it did happen, even though dogs are much more difficult to identify as trade goods than pottery. And unlike other animals, such as fallow deer (Madgwick *et al.* 2013: 111-12), they were present in both late Iron Age and early Roman Britain in equal numbers. There is also a precedent for trading species that already present in Britain: Albarella *et al.* demonstrate that larger domestic livestock, particularly cattle, were imported into Britain from mainland Europe at the end of the Iron Age and during the Roman occupation (2008).

Yet there may be one way of identifying some dogs from the Continent: morphology. This has been an area of some debate since Harcourt's original work on dogs through time in Britain: he originally stated that Iron Age dogs were relatively uniform in morphology, being 'unmodified' (1974: 160). Clark has questioned this assertion on several occasions, arguing that when a greater range of evidence is collected, it suggests that Iron Age dogs had some morphological diversity (Clark 1995; 2000: 168). This is supported in part: as 4.1 demonstrated, Iron Age dogs did show physical diversity, both in terms of cranial and post-cranial attributes. A cranium found in Trumpington, Cambridgeshire, also shows this: loosely carbon-dated to 200 BC - 40 AD, it was likely within the typical withers range of Iron Age dogs, but had a short, flexed muzzle and unusually wide zygomaticus (Baxter and Nussbaumer 2009: 68). Whether this is the product of internal breeding or direct import is impossible to determine. While it is possible the dog may actually come from before the invasion of Gaul, the time range also falls within the time that direct trade relations were taking place between Britain and the Roman Empire.

Yet small morphotypes were almost entirely absent in the Iron Age, and very rapidly increase in number from the Roman period. The one small dog, a chondrodystrophic dwarf of 31cm tall (see 7.4. for more discussion), found in this study was dated to the Late Iron Age and so may have been an import from the Continent. Supporting this idea is the fact it was found on Danebury, a centralised site with wide links, in an area known to trade heavily across the Channel during this time (Cunliffe 2005: 127). There are few other known cases of small dogs in Late Iron Age Britain (Smith 2005: 34) although one was found in a cemetery in Mill Hill, Deal, Kent, dating to the mid second to mid first century BC (Parfitt 1995: 16). However, this dog is at 38cm at withers (Legge 1995: 148-49), far taller than some of the smallest dogs found in the Roman period. It is unknown from the description whether it suffered from any kind of dwarfism, although unlikely as it was noted to be slender.

It is possible that both of these dogs were selectively bred by Britons themselves. However, if this were the case, there would likely be more proportionally small dogs in Britain pre-Conquest, even if they were concentrated in a particular area or region. Even Clark's work, which, argues against Harcourt's conclusion that morphological diversity in Iron Age dogs was low (2000: 168), shows that a wider diversity does not extend to very small individuals. It is also unlikely that Britons were able to produce such small dogs in such a short space of time. Unlike chondrodystrophic 'dwarf' dogs that suffer from a single faulty gene that shortens only their legs (Brown *et al.* 2017: 11476-77), the smallest types of 'proportional dwarf' are more complex. While all share the same variant of insulin-like growth factor 1 (IGF1) gene (which regulates skeletal size), several larger types of dog also share it and several other genes are responsible for determining the exact size and shape of the dog (Rimbault *et al.* 2013: 1985-87). The small dogs in this study all vary greatly in terms of size and shape, and these variations likely need longer-term selective breeding. Therefore, intermediate forms would have existed in the Late Iron Age if this were the case. So the overall reality may be quite complex: Iron Age peoples may have been engaged in selective breeding of different morphotypes, particularly for trade, but they also imported different types of dog, particularly small types, which rapidly accelerated once the Roman Conquest happened.

This is a trend found elsewhere in the Roman Empire; settlements in Pannonia and Hispania show the appearance of previously-absent small dogs after they were incorporated as provinces (Bartosiewicz 2010; Colominas 2016). It is highly unlikely that several provinces simultaneously, and instantaneously, began to selectively breed different types of small dogs on both a large and regionally diverse scale without at least some trade from the Roman Empire to contribute the relevant breeding animals. Where would the necessary genes have come from? The *very* few dogs present in pre-Conquest Britain would have been unlikely to be sufficient in terms of numbers and genetic diversity.

It is unknown how long that this trade continued for but interestingly, sources on dogs from Britain feature throughout the Roman Empire. ps-Oppian's Cynegetica dates 212-216 AD (Kneebone 2016) and like Grattius, catalogues varieties of dogs. A particular type from Britain features: 'There is one valiant breed of tracking dogs, small indeed but as worthy as large dogs to be the theme of song; bred by the wild tribes of the painted Britons and called by the name of Agassaeus. Their size is like that of the weak and greedy domestic table dog: round, very lean, shaggy of hair, dull of eye, it has its feet armed with grievous claws and its mouth sharp with close-set venomous tusks. With its nose especially the Agassian dog is most excellent and in tracking it is best of all; for it is very clever at finding the track of things that walk the earth but skilful too to mark the airy scent.' (ps-Oppian *Cyn*. 1.468-480). It is clear this description was heavily affected by literary tropes: the description of Britons is dubious even before the Conquest, and even less likely 150 years afterwards. The description of poisonous fangs are obviously somewhat fanciful. As with Grattius, it is unlikely that ps-Oppian's dog is based on direct experience, but this does not make the passage useless in historical terms. The term 'Ἀγασσεύς' is particularly interesting: Mersinias notes that it is not a made up name, but the future tense of 'ἄγαμαι' in absolute form, thus likely meaning 'he shall wander' (1998: 130). The term may be derived from an equivalent Latin phrase from a past text. The passage also suggests elite interest in dog breeding have remained by mid-Empire and thus, trading may still operate.

There are also brief references in much later works by the Roman poets Nemesianus and Claudian. The former, writing around 283-284 AD (Scourfield 2016), notes that 'Sundered Britain sends us a swift sort, adapted to hunting-tasks in our world' (Nemes. *Cyn*. 223-226). Claudian's *On Stilcho's Consulship* dates to the very end of the Roman occupation at 399-400 AD (Platnauer 1922), and mentions that Delia's chariots were followed by 'dogs of various shape, breed and character; some whose heavy jowls fit them for big game, some swift of foot, some keen of scent; shaggy Cretans bay, slender Spartans, and Britons that can break the backs of mighty bulls.' (*Stil*. 3. 300-303) Analysing these later texts is more challenging. They may not necessarily mean that particular types of dogs were exported from Britain in the 3rd and 4th century. Indeed, they may have been drawn from earlier sources and even some of the earlier sources discussed here. It is currently disputed whether Nemesianus drew much of his work from Grattius (Platnauer 1922), given the similarities between the two works: both contrast the British dog positively against the Molossean. Claudian's work may be particularly fanciful, given the bucolic aspects of the work: these may have been partially drawn from previous works as a depiction of an ideal dog. Unfortunately, Claudian's work is under-analysed by commentators, and the few commentaries available are generally of little help for these sources: they focus on the literary aspects of these works, and do not consider the historical background of small passages on canines. There is a need for more extensive historical analysis along the lines of Phillips and Willcock, who focus on hounds in their commentaries of Xenophon and Arrian (Phillips and Willcock 1999: 169).

On the other hand, it is noteworthy that the types of dogs described are sometimes very different to earlier references. Ps-Oppian's description of the Agassean is particularly intriguing: despite the possibility that his list of dogs may have been inspired by Grattius (Green 2018: 164), the type is completely unlike any other descriptions, yet reminiscent of the high numbers of short-legged dogs in Roman Britain. Artistic license is the most likely reason. However, it is noteworthy that the short Agassean has no physical resemblance to Iron Age dogs but does correlate with the short chondrodystrophic dogs found in early Roman Britain onwards. These dogs are also found on military sites, which were likely to engage in hunting (Bennett and Timm 2016: 121-122). It is therefore a possibility, albeit an extremely tenuous one, that later texts may not hark back to dogs of Iron Age Britain, but of earlier Roman Britain, where smaller morphotypes were common; thus, dogs may have been traded into Britain, bred and traded back out as supposedly authentic 'British' dogs. Much more work is needed to support this idea of interactive trade, but it is useful to question our assumptions of how mainland-Britannia trade may operate.

All textual sources I have discussed link the export of Roman dogs to elite hunting pursuits, while the archaeological evidence largely links import with smaller morphotypes of unknown purpose. A noteworthy disparity: this difference may be linked to the wider effect on Roman imperialism on human behaviour and identity, which I will explore further once all data analysis is finished. But for now, I have explored the textual evidence with caution. Literary tropes were considered using commentaries, while also discerning the wider historical implications and context.

7.2. Dog Roles in Roman Society

Of the numerous references to dogs in classical sources, several categories may be helpful in exploring this theme in more detail: sentimental depictions of dogs, and the legacy of major agricultural and hunting texts.

7.2.1. Canine Roles in Agricultural Communities

In Roman society, dogs were a crucial part of most farms, used to guard livestock and farm buildings. There are three main agricultural texts pertaining to dogs that survive to the present day: Cato, Varro and Columella's *De Agricultura* and *De Re Rustica* (On Agriculture). The first source mentions dogs in brief, but the second and third have distinct sections devoted to their selection and care. It would be simple to take these extracts at face value, but the history and literary context of the authors is well worth considering.

Marcus Terrentius Varro has a well-documented history as a Roman general, praetor and scholar, until his proscription by Mark Antony in 43BC (Wiseman 2009: 128-129). He fled to the estate of his friend Q. Fufius Calenus, and claimed that he commenced work on his *De Re Rustica* in 35BC. His wife Fundania had purchased an estate, and was in need of guidance on how to run it (Hooper and Ash 1934: xvii). Because of his close involvement in the Roman state, and his own proscription, Nelsestuen argues that Varro's treatise is not only an agricultural manual, but a literary work and piece of political philosophy (2015: 5). The first and third book discuss the estate, arable farming and aviculture, but the second book is the most relevant here. It discusses each of the main animals (and herdsmen) of the farm in turn, in the form of a dialogue between Varro and his friends. In this, Nelsestuen argues that they are playing at being shepherds (2015: 124-127). Unfortunately, this commentary misses the section on dogs and so cannot be used to aid analysis, but it is possible to use the discussion of other sections as a template.

In Chapter 9 of Book 2, Varro discusses the roles of dogs. These are 'two sorts of dogs — the hunting-dog suited to chase the beasts of the forest, and the other which is procured as a watch-dog and is of importance to the shepherd' (Varro *Rust.* 2.9.2). From here, he discusses their ideal characteristics and the age at which they should be purchased, followed by recommendations for their diet and care. Some key points include the discussion on ideal breeds: 'care should also be taken that they be of good breed; accordingly they receive their names from the districts from which they come: Spartans, Epirotes, Sallentines' (2.9.5). Relevant also is the suggestion they be fed 'scraps of meat and bones' and 'barley bread… soaking it in milk' (2.9.8-10).

It is interesting that the friend chosen to talk about sheep, Atticus, also discusses dogs. This suggests there was a close tie between the two: indeed, at the beginning of his monologue about canines, Atticus noted that pigs and cattle are not in need of protection from wolves, as adult pigs and cattle are capable of defending themselves (2.9.1-2). This strengthens the inference that dogs were not used to herd cattle, at least not in the Late Republic. However, there is a key link between Varro and his friends playing as shepherds, and the discussion of dogs as 'guardian of the flock… a champion to defend it' (2.9.1). Nelsestuen's analysis of the sheep dialogue suggests they are used as analogies for non-elite people throughout the text (2015: 140, 152, 155). They may be stand-ins for people in this regard, suggesting close ties between humans and dogs. But on other hand, the latter are still ascribed a kind of servile status in the rest of the passage.

Essentially, dogs seem to occupy a somewhat liminal state in Varro's text: not quite like the other animals, but not like humans either. This may, indirectly, reflect their importance in assisting with human tasks on the farm. Despite the literary and political aspects of the text, the key points and underlying attitudes towards dogs are informative. Indeed, Nelsestuen's commentary does not dispute the *factuality* of most of the content of the other animals, but more acknowledges that it is written from a very elite perspective: the information presented is that of most interest to a prospective estate owner, not its workers (Nelsestuen 2015: 142).

The roles of dogs, and the accuracy of Varro's work, is supported by the other *De Re Rustica*. Lucius Junius Moderatus Columella takes a slightly different approach in his own treatise: writing in around 60-70 AD (Forster 1950: 123), he openly acknowledges the influence of Varro (Baldwin 1963: 786), but adds more rigorous detail. His background may be responsible for this: Baldwin argues that Columella was much more influenced by Hellenistic scientists (1963: 791) and commentators note his work to be a 'textbook' and '"how-to" approach', even while acknowledging the literary elements such as the use of hexameter in the section on gardening and idealism about agriculture as a traditional

‘Roman’ way of life (Forster 1950: 124-5; Doody 2007: 183, 190). Thus, the main agricultural advice likely has a factual basis or intention.

In Book VII, Columella further divides farm dogs into two sub-types: livestock guardians and farm guards and, unlike Varro, he discusses their ideal physiology in detail. Livestock dogs ought to be white in colour to distinguish it from a wild animal (Columella *Rust.* 2.7.3-4) and more robust than ‘lean and swift of foot’ hunting dogs, but less heavily built than a guard dog, who did not need to be swift as they were largely intended to deter intruders at close quarters (2.7.8-9). He recommended farm guards be black in order to appear more intimidating during the day, but be invisible at night (2.7.3-4).

While far less common than hunting dogs in the text, two potential references to guard dogs are present in Virgil’s Georgics. In Book 3, he depicts Libyan herdsmen as taking a ‘Spartan dog’ with him (*G*. 3.339-345). The same type of dog is noted later in the same book, and remarks that, with the Molossian hound, ‘Never, with them on guard, need you fear for your stalls a midnight thief, or onslaught of wolves or restless Spaniards in your rear’ (Verg. *G*. 3.404-408).

The main texts pertaining to dogs as guardians were from elite agricultural treatises, written by owners of vast estates. Large estate management may have specific practices that smaller estates and individual, non-elite farms do not use, particularly in distant provinces where pre-Roman practices may dominate. Many of the prescriptions for the care of dogs are impossible to detect archaeologically, and cannot be explored through other texts, given how few there are pertaining to Britannia. The coat colour and build recommendations that Columella gives, while intriguing, requires much wider morphological and genetic study to explore how common they were across the Empire: many people may have used dogs for these purposes, but used local types or ‘made do’ with whatever dogs were available.

Yet one constant may remain between text and archaeology: the practice of keeping dogs. Although canines are slightly less common on rural sites than urban and nucleated settlements, they are found on most sites across all parts of England. Even with elite practices, canine working roles would likely have a wider applicability to other groups. Dogs were clearly affordable enough to keep on all kinds of rural sites, small and large, but *why* were they there? It is impossible to determine if dogs were used as guard animals, especially with a small number of high-status and villa sites in the dataset, but if they were commonly used to guard sheep in rural areas, some kind of correlation between the two would be expected: especially as some Roman sites shifted towards higher numbers of cattle and pigs (King 1984: 189-94). Spearman's rank correlation (see 3.2.10) is useful for comparing relative levels of dogs and sheep on the Roman Rural Settlement Project sites.

Overall correlation is moderate-to-high at 0.59 and, all correlation values are statistically significant (see Appendix B). The South and Central Belt have the highest correlation in Fig. 7.1, and the North East and East have slightly and moderately lower correlations respectively. However, regional difference is useful but does not explain how much roles *changed* in Britain. Dogs may have already been used to guard sheep long before the Roman Conquest and have a strong association with them. Fig. 7.2 tests this probability except for the Early and Middle Iron Ages, where the dataset was too small to test. Otherwise, the correlation is moderate in the Late Iron Age and rises throughout the Roman period.

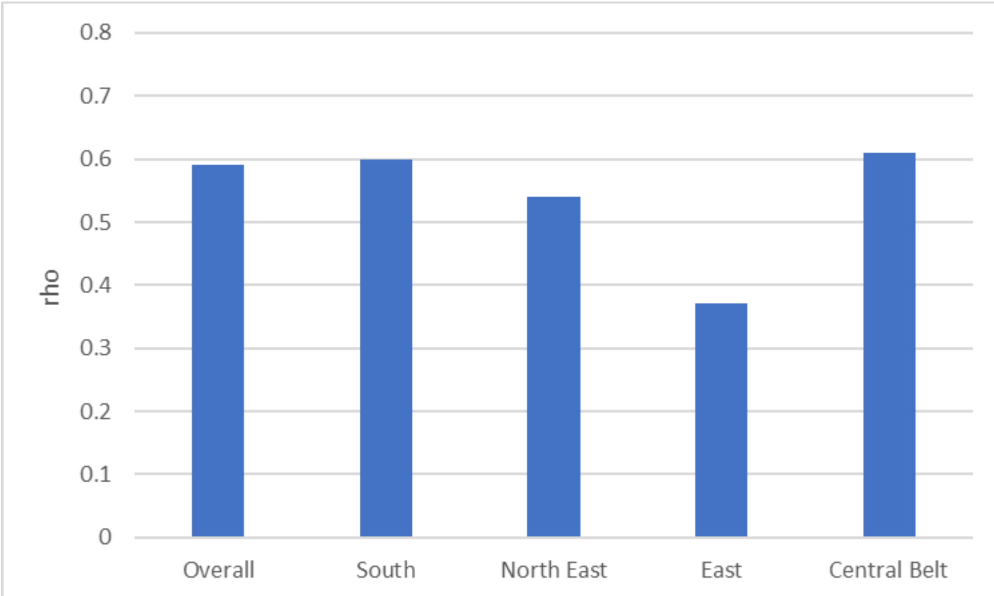

Fig 7.1. Correlation between dog and sheep NISP by region.

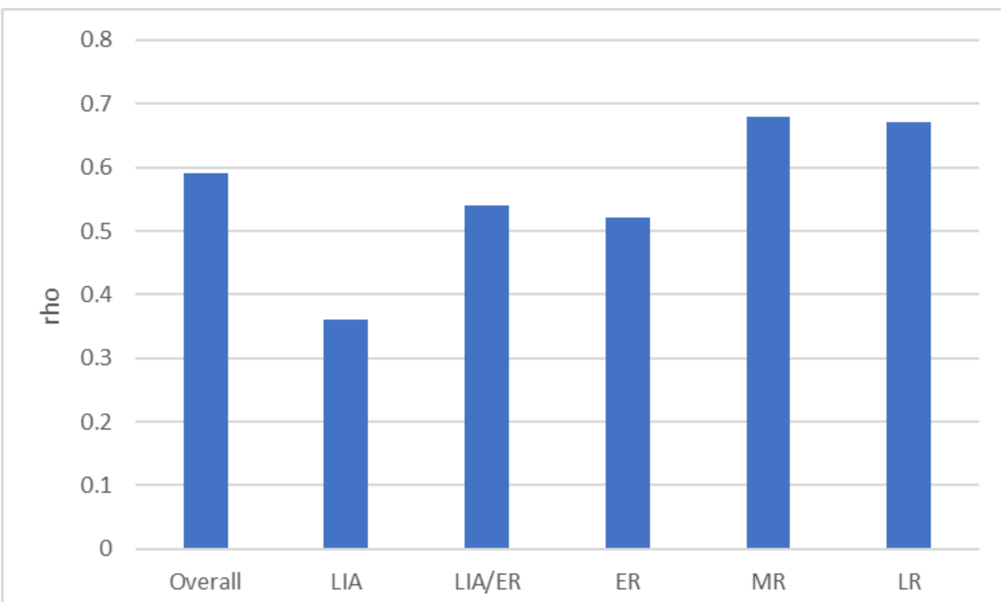

Fig 7.2. Correlation between dog and sheep NISP by phase.

7.2.2. Romans, Dogs and Hunting

Aside from acting as guardians, one of the primary roles of dogs within Roman society was to assist in the hunting of various game. The textual evidence is particularly rich in this regard with serious treatises on its practice existing alongside more lyrical poems. The earliest treatises on hunting come from classical Greece in the form of Xenophon's treatise On Hunting. This text was greatly influential in the development of future texts, and Arrian's and Psuedo-Oppian's treatises of the same name draw heavily upon it. While the poems discuss hunting more generally, including techniques and philosophical reflection, the choice of animals for assistance in the hunt, especially dogs, feature heavily. Indeed, dogs are the only assistance animal mentioned by Xenophon although Arrian introduces horses (Arr. *Cyn*; Xen. *Cyn*).

Xenophon wrote his treatise around 391 BC, and Arrian wrote five hundred years later at c.AD 145/6 (Phillips and Willcock 1999: 21-22). Both were Greek, but Arrian was writing over 250 years after Greece itself had been incorporated within the Roman Empire. Psuedo-Oppian's *Cynegetica* was produced by an unknown author, mistaken to be the Greek poet Oppian, who wrote a similar poem on fishing during the joint rule of Marcus Aurelius and Commodus. Written around AD 212-217 (Kneebone 2016), has had much less dedicated study than Xenophon or Arrian, as discussed in Chapter 4. From a more distinctively Roman perspective, Grattius and Nemesianus both produced poems also titled *Cynegetica*. As with ps-Oppian, I covered these in 7.1, but both discuss dogs in some detail. Grattius in particular names many different types of dogs, with different characteristics and strengths for different types of game.

There is a remarkable degree of continuity between chronologically disparate texts: Arrian noted that his work was an update of Xenophon's volume, and referred to himself as the 'Second Xenophon' (Phillips and Willcock 1999: 22), and historians debate the influence of Arrian on Grattius, and Grattius on Nemesianus in turn. The links suggest that hunting was a consistently popular practice across the Roman period from the Republic through to the later Empire, with both a distinct Greek origin and subsequent Roman influence.

In his review of the volume, Hesk notes that Arrian highly values the new varieties of animal introduced by the Roman Empire, while ignoring this contribution and crediting them fully to Greek cultural tradition (2000). This relation between Greek hunting traditions and the influence of the Roman Empire is a fascinating point of tension, and one that may be echoed elsewhere in the Empire. It is particularly noteworthy, by contrast to this perspective, that the Roman poet Lucian regarded Arrian as a 'Roman of the highest distinction' (Lucian *Alex*. 2). It is entirely possible that a similar form of tension existed in Roman Britain: as outlined in 7.1, hunting dogs were probably exported from Britain, so some form of cultural tradition based on the breeding and use of dogs for hunting existed in some degree before the Conquest. Yet the Romans may have offered new breeds with which to hunt, but whether this was acknowledged or credited to the Empire by Britons, or simply considered a logical extension of previous cultural practice, is difficult to ascertain. Perhaps Romans in Britain actually saw the practice as a chiefly Roman one, by contrast.

Hunting dogs also feature prominently in various scenes in Virgil's Eclogues and Georgics (*Ecl*. 8.28, 10.56-57; *G*. 1.139-140; 3.44). By contrast, he remarks on a lack of hunting dogs amongst the Scythians (*G.* 3.371-372). Whether intended to be based on Roman knowledge of other societies or pure literary trope, the remark is noteworthy. It implies a lack of hunting dogs amongst a group, even if fictional, was seen as unusual and worthy of comment. That pre-Roman Britain had some kind of hunting dogs, whether produced mainly for export or home use by select social groups, suggests The first is that Britons may have been seen as less unusual in terms of their dog-keeping habits, by the Romans, than other groups (conquered or not). The second, more immediate implication, is that dog roles may not have changed too dramatically in this regard. Even if other dogs were perhaps given new roles over time, some were used to hunt both before *and* after the Conquest.

These texts offer superb insights into elite hunting culture, even with the literary connotations about wider cultural issues. Unlike farming, that is practiced in all social strata (albeit perhaps differently), hunting as a whole has much heavier links to the wealthy. Dogs were commonly depicted in hunting scenes on mosaics (Neal and Cosh 2009: 63; see Figs. 7.3 and 7.4), mainly in the west and south-west of England including Cherhill, East Coker, Frampton, Littlecote, Withington and Whatley (Neal and Cosh 2006; 2010). These mosaics were found in the houses and villas of affluent citizens (Neal and Cosh 2006: 3-5) and likely had the closest links to their practices and ideals. Dogs were also depicted on fine beakers in both Cologne Colour-Coated and Nene Valley wares (Darling and Precious 2014: 16). Yet just how common hunting was in everyday life, outside of elite circles, is far more questionable than the use of dogs on farms.

Fig. 7.3. Mosaic from Hinton St. Mary, depicting several dogs hunting deer (Neal and Cosh 2006: 158; mosaic 171.1).

Fig. 7.4. Mosaic from Cirencester depicting hunting dogs in centre (Neal and Cosh 2010: 107; mosaic 421.45).

Dogs and hunting, however, may be explored in a similar way to the dog-sheep link but using wild animals instead, as they were used to hunt animals of all sizes. Deer and hares were known to be hunted in this way and so have been grouped together. More generally, it is well established that wild animals form a much smaller part of bone assemblages than during the Bronze Age, and that Iron Age peoples did not appear to hunt as frequently (Hambleton 2008: 34-35; Hill 1995: 104). If the Roman emphasis on hunting had a deeper influence on Britain (or parts of it) beyond new dog breeds, we may expect to see a greater correlation between dogs and wild animals relative to the Iron Age. Yet comparing dog correlation with wild animals is more difficult than sheep. Sheep are present on nearly all sites; wild animals, however, are much rarer and smaller in number on Romano-British sites (Maltby 2016), meaning that many site phases have zero dog bones and zero wild animals. This condition will create a lot of tied ranks, which Spearman's rank correlation struggles with (Field 2009: 181). With this in mind, I have used two methods to compare against each other: Spearman with all ties removed, and Kendall Tau (see 3.2.10).

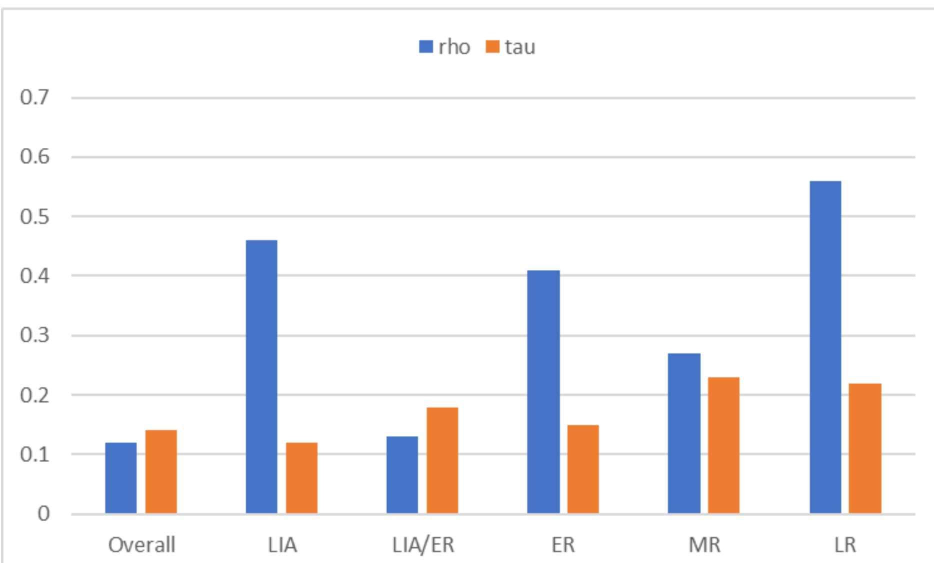

Fig 7.5. Correlation between dog and wild animal NISP by phase.

Spearman's and Kendall Tau produce rather different results. The rho values, indicating strength of correlation, are higher but also more variable: correlations fluctuate from weak to moderate through time and do not rise or fall consistently (see Fig. 7.5). Tau numbers indicate a weak correlation that rises slightly through time, to a maximum of 0.23 in the Middle Roman period. Dog numbers do correlate with wild animals, but less strongly than between dogs and sheep. Overall correlation may be closer to tau results, given this method's better results with tied pairs.

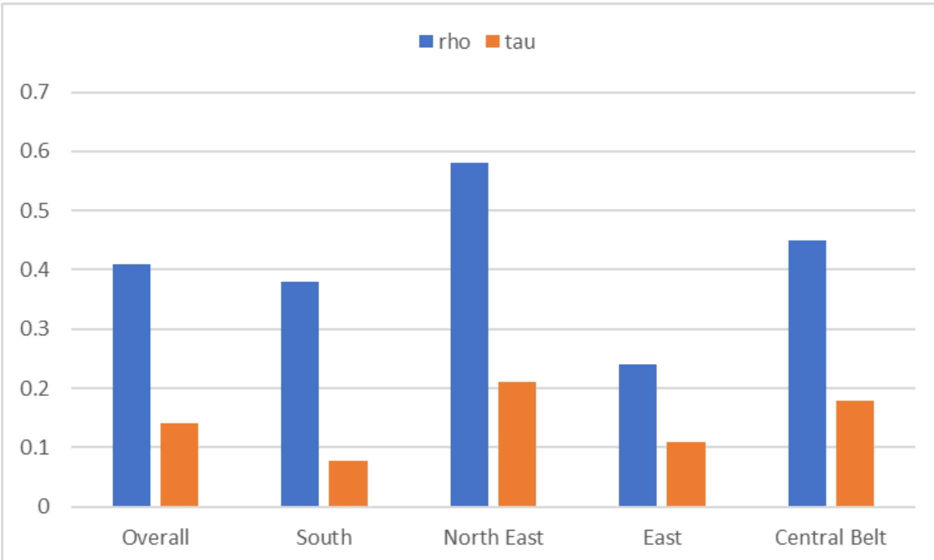

Fig 7.6. Correlation between dog and wild animal NISP by region.

Hunting with dogs is a practice that may also have varied by region, especially given cultural differences between the various Iron Age groups. For all major regions, Spearman's return significant values. However, the correlation itself is positive (albeit variable) for both (see Appendix B). When broken down by region in Fig. 7.6, the Spearman correlation varies somewhat. Correlation is highest in the North East and lowest in the South. Kendall Tau, better able to cope with tied pairs, gives significant results. Each region except for the East is statistically significant, with a positive but weak correlation, following the same pattern as the Spearman correlation. The weaker correlation from Kendall Tau suggests that some correlation between dogs and wild animals existed, but was less strong than dogs and sheep. This result may be, in part, due to the smaller number of sites with wild animals and would benefit from testing with a larger dataset.

7.2.3. Dogs and Sentimentality

On the whole, the Roman literature is frank about both the prized qualities (Lucr. 864-865; Plut. *Mor. De fort. Rom*. 98; *De soll. an*. 969, 973) and the shortcomings of dogs (e.g. Epict. *Diss.* 2.24; Plut. *Mor. Quaest. Rom.* 290). By Roman, this refers to both works in Latin and Greek. Greek writers such as Plutarch and Arrian acquired Roman citizenship and kept the company of elite Romans (Bosworth 2015; Russell 2015), many of whom could read the language and even kept private libraries containing Greek works (Rawson 1985: 40, 55). Other texts compare human characteristics against dogs, in both positive and negative ways (e.g. Cic. *Pis.* 23; *Lucian Vit. auct*. 7). Attitudes towards dogs are less focused in one genre than the more functional discussions on them, but provides a richer and more diverse picture for it.

The literature also considers personal relations with dogs. Although there are far too many to discuss in their entirety, there are several key examples worth reviewing. Martial wrote two epigrams about dogs: Issa and Lydia (*Mart.* 1.109; 9.69). Cicero recounts the death of the little dog Persa, not only as an omen for the death of King Perses, but as a source of great sorrow for Lucius Paulus' daughter Tertia (*Div.* 1.103). There is debate over whether Martial's epigram of Issa was satirical, and mocking his friend Publius (Fleck 2008), but this is noteworthy: an attitude cannot be mocked if others did not hold it in the first place. Iconography often depicts dogs in domestic or funerary situations, often with women or children (see Figs 7.7 and 7.8 for examples). These dogs tend to be rather small in size, suggesting that small dogs in particular may have been prized for their companionship and closeness to humans. Small dogs are also noted in both Greek and Roman texts, often as the 'Melitean' dog frequently in domestic settings or as companion animals (Lazenby 1949: 246; Phillips 2011: 94).

Fig. 7.7. Funerary relief of Ulpia Epigone depicting a woman and small dog: originally on the Tomb of the Volusii, Rome, dating to the late 1st/early 2nd century AD (D'Ambra 1989).

Fig. 7.8. Relief of child with dog: found in Egypt, dating to the late 2nd century BC or later (Walker and Higgs 2001: 152).

But even Arrian discusses his prized hound, Horme, in an affectionate way: '…Never previously did any other dog long to be with me and my fellow-huntsman Megillus as she does… when she sees I am there she smiles and goes on again… And so I think that I should not hesitate to write down the name of this dog, for it to survive her even in the future,' (*Cyn*. 5.2-6). From this, it seems that Roman dogs could be loved greatly regardless of their size or function, meaning that the breeding of very small dogs may not have been simply for the purposes of creating pets, and that larger dogs could be valued beyond their working role. As these texts were written by the elite, they give a fascinating glimpse into the lives of dogs in cities, as well as country estates. These glimpses are briefer than that of the farm dog or hound of the chase, but are useful in thinking about how their lives may have been different in a unique environment. But not all dogs in Rome had owners: references to strays are common, not least Julius Obsequens' copy of Livy from the 4th century AD: 'The howling of dogs was heard by night before the residence of the Chief Pontiff, and the fact that the largest dog was torn by the others foretold unseemly disgrace to Lepidus' (Obseq. 68).

7.2.4. In Rome, as in Dorchester?

In summary, Roman textual attitudes towards dogs had a very wide range: there appeared to be room for wholescale contempt of dogs, to mixed appraisal of their merits, to cherishing them. How influential these attitudes were in Roman Britain is extremely difficult to discern. The texts outline three main roles for dogs, which may overlap with one another: guardians (whether of livestock or inanimate property), hunters and companions. References to dogs used in warfare exist (Forster 1941), but these are too few and fleeting to explore as fully as the other roles. Most noted in Forster overlap with the use of dogs as guardians or hunters, except to guard military encampments instead of private property, and track hidden foes instead of quarry (1941: 115-116). Quotes about dedicated *attack* dogs are exceedingly rare.

How applicable these texts are, outside of elite writers, is an intriguing question.

As companions, both small dogs and large dogs appear to have been chosen. Artistic evidence, however, suggests small dogs may have been more frequent companions than large, particularly to women and children. Linked to Britain, the spread of smaller dogs province-wide may indicate a rise in dogs as companions. Yet it may lead to the assumption that larger dogs were not cared for to the same extent, both before and after the Roman Conquest. Small dogs may also have been imported purposes other than companionship. Both functional and social reasons may be possible: given that urbanism brought about a rise in rats (Baxter 2006: 20), dogs may have been utilised as ratters. They may also have been kept as luxury objects to signify social status, just as valuable material goods were. The higher number of small dogs in urban settings (4.3.3; Bellis 2018) is thus ambiguous, and has a number of potential causes.

Specifically, the role of companion dog has overlap with the other types. Arrian's hound, Horme, was described to be both a hunting dog and a companion, albeit at different stages of her life. However, no sources discuss a dog that was both a hunting and guard animal. Varro and Columella note the two types were distinct from each other, e.g. 'two sorts of dogs – the hunting-dog suited to chase the beasts of the forest, and the other which is… a watch-dog and is of importance to the shepherd' (Columella *Rust*. 8.12-12; Varro *Rust*. 2.9.2). This suggests they were likely bred as separate lineages, at least in elite circles.

Britain, both pre- and post-Conquest, may not have followed these guidelines as carefully. Yet I would venture that overlap between hunting and guard dogs were unlikely. The different roles would have required entirely different training, even if the dogs themselves were not bred for specific purposes. However, it is likely that some dogs were selectively bred for distinct functions. While their mention in hunting texts may have been, at least partly, ideological, the keenness of elite Romans to acquire and breed dogs suggests they would have would have sought dogs from Britain.

7.3. In Life and Death: Individual Canine Stories

Thus far, the focus has been on the overall attributes of dogs, such as age, pathology, general roles and movements in and out of Britain. This has been very valuable for understanding the dogs as a group and as discrete populations from before and after the Roman Conquest. Now this section will go another step further. Essentially, I will create biographies of the individual dogs using *all* the information collected from the ABGs. These biographies can then be compared between different categories, for an understanding of how one factor in a dog's life may affect everything else. Although these biographies will be based on the data provided by the ABGs, and are therefore limited by both the thanatocoenoses (death assemblage) and the taphonocoenose (recovered assemblage) they are designed to go beyond this and attempt to reconstruct the biocoenose (life assemblage; Lyman 2008: 22, 26). In short, they are designed to look at the dogs in life.

Select biographies will be used to demonstrate how they may tell the story of a dog's life. The main themes of each biography are of health, welfare, and potential roles. Even though 85 sounds like a comparatively small number, the sheer amount of data makes their full inclusion in the chapter impossible. This section is designed to be used with Appendix A, which contains the biography of each dog. Each biography discusses the life of the dog, when it died, and what happened to it after death. For each biography in Appendix A, the life part is on the left side of the page, and the death section on the right side. The biographies will be made up of the following components:

Life Biographies

A dog's life biography has parts that are consistent throughout its life, such as its size and shape, sex, congenital issues, and the approximate time period in which it lived. There are other parts that may change through its life, such as where it lived, what it ate, its age and the development of age-related pathology. Then there are specific events that happen, such as physical trauma and its eventual death.

The biography for each dog is not only designed to catalogue each aspect of its life, but consider how they affected one another and what they signify about human-dog relationships. Some of these have obvious links: for instance, a very large dog will be more prone to developing certain arthropathies, due to its greater bodyweight. But others may be more subtle, and only become apparent once they are compared. Each biography will cover the three stages, but in varying levels of detail. In particular, a few of the ABGs have stable isotope data but most do not. The four aetiology categories span these stages: congenital conditions are lifelong, arthropathy develops through a dog's lifetime, and trauma and disease occur as an event in its life. The consequences of this event, however, may be lifelong.

Death Biographies

The death biography has a different set of stages. From the dog's death, there is the original treatment of the body, which could be undertaken by the dog's owner or designated individual/s within the owner's social network. However, it is entirely plausible that it is done by other/s, particularly if the dog had no owner. This first stage includes any butchery and deposition of the corpse. Then there is the second stage between deposition and the final burial (which does not necessarily mean formal burial, but simply the point by which the body is covered by some kind of matter), which may include gnawing, if the stage is long enough and the corpse available to scavengers. This stage may be somewhat indeterminate if burial is shallow, as scavengers may dig up and retrieve parts, but it still applies broadly.

Finally, there is a much longer stage that encompasses burial through to the recovery and processing of the bones by archaeologists, and this includes the overall preservation. Completeness of the final ABG may be affected by any one, or all, of these stages. These stages correlate roughly with Lyman's thanatocoenose and taphonocoenose (2008: 22, 26), but break down the thanatocoenose into two stages. While most difference will be found between the life and death biographies, there is still scope for investigating how the stages in death are related to one another. Is there a link between the rate of gnawing and the eventual standard of preservation?

Comparing Life and Death Biographies

Is there any correlation between a dog's life and death biography? Do aspects of its life affect it in death? The most obvious characteristic that may affect a dog is its size. A dog's physiology makes it more or less vulnerable to certain health conditions, but also affects its place within human society. This may be a formal role, but may also influence how it is treated day-to-day less formally.

From the biographies, I will select 10 of the most interesting and/or complete to tell as stories in full, while considering the narrative limitations of some other biographies. Essentially, what makes some biographies into ideal story material and not others? Stories about animals are not a modern invention. The genre has had small surges of popularity through time, with medieval manuscripts featuring the stories of Husdent, a major character (and dog) in the tale of Tristan and Ilsolde. Another popular subject for illustrated manuscripts was King of the Garamantes being rescued by his dogs (Eddy 2013), which was originally derived from an account in Pliny the Elder (*HN.* 8.142). An entire book was written about Trim, the cat aboard the HMS *Investigator,* the ship sailed by Matthew Flinders around the entirety of Australia in 1801-3 (Flinders 1997). Even within the ancient world, a few select animals received the honor of being lauded by ancient authors. The most striking example is Arrian's account of his beloved hound, Horme. While touched upon briefly in 7.2.3, the full story reads as follows:

'For I myself reared a hound with the greyest of grey eyes, and she was fast and a hard worker and spirited and agile, so that when she was young she once dealt with four hares

in a day. And apart from that she is most gentle (I still had her when I was writing this) and most fond of humans, and never previously did any other dog long to be with me and my fellow-huntsman Megillus as she does. For since she was retired from the chase, she never leaves us, or at least one of us. If I am indoors she stays with me, and accompanies me if I go out anywhere; she escorts me to the gymnasium, and sits by while I am exercising, and goes in front as I return, frequently turning around as if to check I have not left the road somewhere; when she sees me I am there she smiles and goes on again in front. But if I go off to some public business, she stays with my friend, and behaves in the same way to him. If one of us is ill, she does not leave him. If she sees us after even a short period of time, she jumps up in the air gently, as if welcoming him, and she gives a bark with the welcome, showing her affection. When she is with one of us at dinner she touches him with her paws alternately, reminding him that she too should be given some of the food. And indeed she makes many different noises, more than any other dog that I think I have seen; and she shows audibly what she wants. And because when she was being trained as a puppy she was punished with a whip, if anyone even to this day should mention a whip, she goes up to the one who said it and crouches down like one beseeching, and fits her mouth to his mouth as if she is kissing, and jumps up and hangs from his neck, and does not let him go until the angry one gives up the threat. And so I think that I should not hesitate to write down the name of this dog, for it to survive her even in the future, that Xenophon the Athenian [Arrian, who was referred to as 'the second Xenophon'] *had a dog called Horme, very fast and very clever and quite out of this world'* (Arr. *Cyn*. 5.1-6)

All accounts illustrate the relationships the animals concerned had with humans very well, and they show the value of reconstructing stories from animal skeletons. This range of stories will be temporally and geographically diverse, spanning from the south of England to the East, and through both the Iron Age and Roman periods. The narrative will not follow a chronological or spatial path, but build up to the most dramatic and detailed stories that this dataset holds. Because they build upon the facts established in the original biographies, the stories will weave them into a narrative that may use small amounts of speculation to fill gaps or consider the wider meaning of a particular attribute or event. The value a story brings over a basic list of attributes far outweighs the possible issue of inaccuracies, which archaeology, as a field, cannot avoid if it is to do more than present a laundry list of objects and sites. Nonetheless, I suggest reading the stories in the spirit of a best-guess reconstruction of canine lives. For narrative quality, some of the diagnostic specifics may be left out: for details on unusual or complex pathologies, refer back to Appendices A, C and E for details. Appendix A contains summary details, Appendix C contains photos, and Appendix E contains the lesion details and differential diagnoses for the most unusual pathology. All may be searched for easily using the ABG ID.

7.4. Ten Dogs, Ten Stories

7.4.1. Iron Age Dog Stories

HD-2: A Ritual Death?

HD-2 died extremely young. One of the youngest dogs I found, it had died old enough for its adult teeth to erupt, but still so immature that most of its bones had not fused. Thus, it had lived for at least three months, but unlikely much longer than this. Its adult teeth had clearly just emerged, as there were no signs of wear whatsoever. Despite its age, its skeleton was large, as large as many of the other adult dogs I found that could be measured. Had it lived to adulthood, HD-2 would have been a particularly large and imposing dog, perhaps on par with some of the largest dogs at around 55cm tall.

Many puppies and young dogs likely died for unavoidable reasons, such as disease or infection following an injury. Others died when extremely young, killed perhaps to control the population. HD-2, however, had no indication of injury or disease. But once it was dead, it was disembowelled and perhaps skinned as well. This act is unprecedented, both in Iron Age and Roman times. It could represent either an act of desperation, or a very rare ritual. Either way, it makes the circumstances of the dog's death rather suspicious, and there is a high likelihood it was killed specifically for this reason. Despite the nature of its death, however, the deposition of the body was not unusual. Many Iron Age dogs were buried in pits, just as HD-2 was. After death, the dog may have been buried in a way befitting a wider belief system, which may have had its own ritual components.

DA-6: A Well-Travelled Dog?

A dog that lived sometime in the Late Iron Age, DA-6 had one very unusual characteristic: it was small. Most dogs in Iron Age Britain were either medium sized or large animals. Small dogs were found in the Late Iron Age, but were rare finds and likely Continental imports. Of the 25 Iron Age dogs I investigated, this one was the only small animal found. Why was it present? The dog may have represented many different things, perhaps at the same time: an exotic creature, a luxury status item, or an animal with ritual functions. Any ritual, however, was likely to be carried out when the animal was still alive.

The dog appeared to be in fairly good health aside from a few slight growths around the joints, suggesting the dog had died in Danebury when it was middle aged or older. How it spent its earlier life is the more interesting question. The dog may have been born on the Continent, and brought over to Britain when it was a puppy or adult. And if so, how it reached Danebury is another curious event. The dog may have been sold to someone on Danebury, perhaps when other goods were being traded, or given as a gift. After all, we know that some elites in Britain were in contact with the Roman Empire, and sold goods back to them in turn.

There is a great opportunity to continue, or at least flesh out DA-6's story some more. If it was born outside of Britain, strontium or oxygen isotope analysis could show where it came from. A fallow deer from Fishbourne was analysed using the former, and revealed it was born in and transported to Britain in the first few months of its life. The method could also indicate diet quality: since the dog was a rarity, it may have been treated differently to others.

BC-3: A Family Matter?

BC-3's story begins a little differently to the others. Most animals' stories begin when we see lesions or unusual adult physiology. Here, the story may be different. BC-3 has no adverse sign of anything adverse happening after six months. Indeed, the dog appeared to die rather young: old enough to reach adulthood, but too young to wear down its teeth like many other dogs, particularly other Iron Age dogs. Perhaps it died at two or three years old. After death, it was seemingly treated soberly: not skinned or left out for scavengers to gnaw, but buried quietly in a pit.

The hint that anything significant happened lies in one of the dog's teeth. One of its first molars has holes in the enamel, exposing the dentin beneath. The lines are smooth, suggesting it was not direct trauma that chipped the enamel away. What did cause this? The most likely possibility is that the dog experienced stress during enamel development when it was a very young puppy. Unfortunately, it was not buried with its litter-mates, so they cannot be investigated to see if the problem affected the whole group when growing.

But what this lesion does reveal is that this very young puppy may have experienced severe stress, illness or nutritional problems. How much human actions were responsible is the most interesting question: it may potentially suggest lack of care of a litter of young pups.

BC-4: Not Just a Bad Back

Another dog on Balksbury Camp, labelled BC-4, shows a rather longer life than its contemporary BC-3. Its teeth are much more heavily worn, indicating a reasonably long life at least. But this life had problems. Its spine has huge, ridged growths on several of the vertebrae. In between disks, the bone was being destroyed, leaving vulnerable spongy bone and slight hollows where healthy, robust cancellous bone should be.

Such a ghastly condition must have left the dog in incredible pain, and appears to have been present for some time. Essentially, the intervertebral disks had become severely inflamed, and showed no signs of stopping. Given how localised it was, it is possible that the condition was triggered by a severe injury and/or infection.

How this injury may have arisen is another matter. The dog stood at 48cm high at the shoulder: a medium-to-large dog of perfect size for guarding or keeping watch. Which is not to say that it did any of these things. But a working injury or freak accident is possible. The location of the spine leaves some pause: when abuse happens, it tends to affect the back and head, ideal targets for human ire. But it does not necessarily mean that abuse did happen, even if the possibility follows this story. Death is another, equally puzzling end to the story. The infection may have spread to the bloodstream and killed the dog. Or humans may have intervened - whether for good or bad intentions.

SF - 1: The Last Supper

What dogs typically ate during their lives is a fascinating, but difficult to answer question. Stable isotope analysis can indicate overall dietary quality and composition, but not the exact foodstuffs consumed. Calculus may indicate a high carbohydrate diet, but is rare and easily lost during cleaning of the bone. While ancient texts discuss specific foods, how accurate they are across thousands of miles is questionable. Barley bread was noted to be a common food for dogs in mainland Europe.

SF-1's final supper was certainly not barley bread. Several small, cube-shaped bones, partly digested but appearing to be cattle carpals, were found in its stomach when archaeologists recovered it. The dog had clearly enjoyed a number of small bones shortly before death, whether scavenged scraps or given by a human. Its earlier life may have been no less interesting. One of its ribs has a healed fracture, and its ankles had clearly seen better days. The small bones had heavy growth on them, suggesting possible stiffness or slightly limited mobility.

How these lesions happened is debatable. Joint issues may happen in older dogs, but rib injuries may be caused by a kick or blow. The dog was tall but of average build, standing 58cm high at the shoulder. It is possible that the animal both experienced joint problems from age, and was hit by a human or other animal sometime during adult life. That the fracture healed fully indicates it was injured much earlier in life, long before it died.

7.4.2. Roman Dog Stories

GY-7: A Blow to the Head

GY-7 lived in the town of Durnovaria at the end of Roman occupation. It was a male dwarf dog, at around 31 cm tall, with disproportionately short, twisted limbs and a long snout for its size. Sometime, probably in young adulthood, the dog was hit with a hard implement on the snout. The nasal bone was broken in half, both across and down the middle. But the animal survived to tell the tale: the break was partly healed by the time it died. Why did this happen? Given the probable intentional nature, abuse is likely. But perhaps that's not all there is to this story: there are several possibilities, given the fact its head injury is both very unambiguous *how* it happened, yet very unclear *why* it happened. Here I will explore these different scenarios:

The first is that GY-7 was attacked by an animal when hunting, perhaps a boar or large deer. It is also possible that a horse kicked it, whether by accident or intentionally. It is highly unlikely that a human caused such a blow by mistake, but the dog may have been attacked by an intruder when guarding a house or other property.

There are other possibilities. GY-7 may have been hit intentionally, but not because of abuse: it may have been defensively hit when showing aggression. Of course, the possibility of abuse by either the owner or another person is ever present.

We have no way of knowing which one is true. It is easy to presume human abuse, and indeed this is very likely. But even abuse may not be by the owner, but come from an unfamiliar person, perhaps a person who was attempting to rob or attack GY-7's owner. Many Roman texts noted the use of dogs as guard animals, and presumably this did not always deter would-be thieves. However, this dog is quite short, and does not conform to the ideal for a guard animal that Columella outlines. But this does not mean that a short dog could not have been used as a watch dog, far from the elite circles, in a crowded urban area towards the end of the Roman occupation. Either way, the dog lived until middle age or older, long enough to wear down its teeth fairly heavily. At death, it was deposited in a cess pit that may have been used exclusively for animal remains.

CA-2: Horme The Pampered

I wrote two stories for CA-2, as it was affected by some of the most unusual pathology of the whole dataset. The first is a technical, strictly factual account: the second builds upon these facts and interprets them.

Biography 1: Technical Version

CRTD7536 was of much later provenance, dating from the late 3rd to early 5th century AD. It was found in Caistor, or Roman Venta Icenorum, with good preservation. Many bones were absent, with skull fragments, right pelvis, half of the vertebral column and longbones present. Many of the latter were fragmented, but include the humeri, left ulna, right femur, and both tibiae. The only parts of the skull recovered were fragments of the occipital, temporal and parietal bones.

The dog was short, at 30.6cm at withers, but with a fairly robust SI of 9.6. Chondrodystrophy seemed to be present, with slight bowing of the tibia, but to a less severe extent than other dogs (for instance, FB-1). Some of the most unusual pathology of the whole dataset occured in this animal. A large callus was present on the back of the acetabulum on the caudal third. It is likely, but not certain, that this was a healed acetabular fracture: the corresponding area on the front was partially missing. The callus corresponded well with the common pattern of caudal acetabular fracture, and no other satisfactory explanation could be found for the lesion. Another unusual issue was swelling in the distal metaphysis of the tibia and femur: this may be due to rickets.

Biography 2: Story Version

My name for the dog is the somewhat clinical CA-2. But that's designed to be an easily-used reference in a database, not a real name. So, let's call her Horme - the Latin for impulse, and a name noted in classical texts. Horme was born in Venta Icenorum sometime between the third and early fifth century AD, a small town in the far-flung Roman province of Britannia. She grew to be a short, bow-legged dog, about the same size as a basset hound.

Life for the young Horme was fairly uneventful, until one day she broke her pelvis in a serious accident. Urban spaces were noted by ancient authors to be hazardous places, and she may have fallen or been hit by a passing cart. In the modern day, this is a break often caused by car accidents, with a difficult and sometimes grim prognosis. Remarkably, Horme not only survived this injury, but recovered. How, and why?

The accident happened when Horme was young, and young dogs always recover better from fractures than older dogs, much like us humans. Being kept indoors, immobilised, helped too, but caused another problem: vitamin D deficiency. Dogs need sunlight exposure just as much as humans, and a lack is not good for a growing dog. In this case, it caused rickets. Still, Horme’s carer was clearly very devoted: to not only look after an ill dog, but also feed it the best possible food. Indeed, Horme's diet was the best of any we've ever known in Iron Age and Roman Britain.

But sadly, despite all this, Horme died somewhere around middle age, likely of a sudden illness. She was swiftly buried, but unfortunately this did not stop most of her skeleton being lost at one point or another. In the present day, we only found a third of her skeleton.

CA-1: What Small Bones You Have…

An explosion in the number of small dogs found in Britain occurs in the Roman period, with many different sizes and varieties represented. They were found all over Britannia, from cities in the South to Vindolanda on Hadrian's Wall. The small town of Caistor, however, contains one of the smallest yet known. With limbs both short and gracile, CA-1 is a curious animal. Too small to be a known variety of scenthound, and about as small and slender as a Pomeranian, its function is a matter of question.

Dogs were likely used in urban contexts to hunt rats and keep their numbers under control. But the circumstances of its burial bring this into question. After death, the animal was buried in a separate context, but still very close to a human. This person was a man, about middle age, and with significant disabilities. A dog as small as CA-1 may have been an ideal companion for the man as a lapdog. It may also have been selected as a reflection of the owner's character or identity, particularly if the dog was seen as a more 'Roman' animal.

CA-1 personally experienced effects from its tiny size. It had no third molar, a benign adaptation to its small jaws, but also had twisted and crowded teeth: one of its premolars had so little room, it was turned inwards at a near-90 degree angle. This crowding may have interfered with its ability to eat comfortably, and it may have lost another premolar for this reason. No other health issues could otherwise be seen, but the dog died quite young, in early adulthood.

One of the few dogs we have stable isotope data on, the dog had a better diet than many contemporary dogs, but not as high quality as another Caistor dog, CA-2. Its diet may indicate that it was less close to its owner than CA-2, but could also be tied with human status. Sykes' work on Iron Age chickens found that, for those buried with humans, the fowls' quality of diet was very similar to the humans'. If a human had a high quality diet, indicating wealth, the chicken did too. The same pattern may apply here: some people in Caistor may have been able to afford better diets for their dogs than others.

OW-13: Brittle Bones

At first glance, OW-13's story is a standard yet uneventful one. Born in the 4th century AD, the dog has the short, bowed limbs of chondrodystrophic animals. It stood about 35cm in height. Initially, the dog was assumed to be a fairly ordinary canine with no unusual issues. But one of the humeri had broken open after death or during recovery: inside was trabecular bone in the medullary cavity of the shaft. Known as osteopetrosis, this is a rare and serious condition.

The dog may have been born with this condition, inherited from recessive alleles from its parents. There is a small likelihood that it developed as a result of the canine distemper virus, in which case, the animal would likely have died. Another possibility is that it was caused by uncontrolled and abnormal cell growth, known as a neoplasm or tumor. These may be benign or malignant (cancerous).

if it lived with osteopetrosis, whatever the cause, the dog would have been ill through its life, with at least some degree of anaemia due to the replacement of marrow with bone. How the humans around it reacted is difficult to say. They may not have been aware of the condition, but, given that it did not break any bones before dying, it may have been treated with care to ensure it stayed as well as possible. Such an animal would be unlikely to be a working dog, given the brittleness of its bones.

The dog lived at least until adulthood, but died at an unknown age afterwards, likely from complications related to its condition. The exact circumstances around its burial are unknown, but it was found in a quarry fill.

OW-1: Completely Uneventful?

OW-1 lived to a good age for a dog, likely seven years or more. Most other dogs lived to early adulthood, if they reached maturity at all. Our dog would have felt the strain of older age in all its limbs, which had several tiny enthesophytes, signs of bone lipping, and heavily worn teeth. But otherwise, their life seemed almost uneventful. No pathology that suggested physical trauma or disease could be found. This is very interesting, given that they were the same size and build as a Border Collie, and many other Iron Age and Roman dogs show possible occupational trauma.

Was it a working animal? Perhaps not. They also had some unusual traits: the third molars were missing. This usually happens in very small dogs, as their jaws lack room for all the teeth, but not larger dogs. However, it had a rather narrow snout, narrower than dogs of a similar size. The tibiae had matching, anomalous grooves that may also suggest unusual origins, perhaps from a lineage of dogs from mainland Europe. Owslebury in the 1st century AD, where it lived, was a large and unusual rural settlement, with a truly staggering assemblage of bones retrieved, more than even the largest cities. Many dogs were found, of all shapes and sizes. So it is perhaps not surprising that an unusual dog also was found there. Either the dog was in particularly good health, or kept for reasons beyond a working role.

Buried with obvious care, nearly all of the skeleton has survived to the present day. I found it the best-preserved skeleton of this entire project. Although the details are hazy, they were buried in a pit, with no other animals.

7.4.3. What About the Missing Dogs?

The above stories show some fascinating insights into these dogs, but are highly selective. They focus on the dogs with the most interesting health conditions, most striking physical traits, best post-mortem survival or longest lives. What about those dogs that fit none of these categories? The standard size dog that dies young, with no interesting traits or conditions? This does not mean that they have no interesting story to tell. A dog that dies young may have died for a very particular reason; for instance, rabies was (and still is) a particularly dramatic and feared disease, yet leaves no trace on the bones. The fact that a dog that survived in fairly good health is significant in of itself. However, these are stories that had little impact osteologically and are thus very difficult to tell.

26 ABGs have no pathology at all, and thus no health-related stories to tell. Another 17 did not reach adulthood, and thus had short stories: many of these also had no pathology. Many other dogs had minor lesions, such as slight osteophytes or lipping associated with age. Negative inferences may be drawn, and thus used to create some form of outline of their lives. Many dogs did not have fractures. Many dogs died young. One example, OW-9, can be discussed in this way. The animal did not suffer any health issues, and had a short life, dying before reaching adulthood. But it is hard to weave these features into stories in of themselves: all ten dogs are about what *did* happen in their lives. So while the stories above are fascinating, and showcase the range of lives experienced by Iron Age and Roman dogs in Britain, they are limited because of the kinds of lives they cannot depict: nondescript lives of nondescript dogs, and very interesting or noteworthy lives that fail to leave traces in the archaeological record. They need to be read with care. Essentially, the canine stories are somewhat over-representative of unwell or unusual dogs.

7.5. The Pieces of Human-Canine Relationships

Finally, after a comprehensive analysis of dog numbers, metrics and pathology, the individual ABGs have had a chance to shine. This was an ideal opportunity to explore the process of creating a detailed biography, more speculative on the life of the dog than the more simple biographies of Appendix A, which is one of the key aims of this research. The biography is particularly helpful for refining pathology, by contextualising it and allowing for a more precise insight into why it may have occurred. Creating both simple and detailed biographies showed that the step from biographical fact list to biographical story is a tricky one. Should we prioritise sticking to the facts, to the detriment of the story? Or do we risk overstepping and potentially creating a misleading idea of the dog's life? I have tried to explore these issues and come to a compromise, by offering some more story-like interpretations of select ABGs, alongside the more definitive biographies in the appendix. The stories create new possibilities for interpretation, such as the effect that one attribute or event may have had on another aspect of health; this is particularly apparent in the case of CA-2.

A range of life (and death) experiences are revealed through focusing on dogs beyond a basic biography. A couple, namely CA-2 and OW-13, showed potential signs of care. On the other hand, ABGs such as GY-7 and BC-4 may have been abused by humans, and some dogs suffered from health problems that were inherited. Others shed light on human activities and lives: DA-6 may have travelled far across Europe, and CA-1 may have been fed as well as its owner could afford. Even ritual activities with dogs are found, with HD-2 butchered in a very unusual way after death.

How typical these stories were is another matter. Not all dogs were explicitly cared for or abused, or closely involved in human activity, ritual or otherwise. Many were of standard size and morphology with no major congenital problems. These stories do not represent many other ABGs in the group, who showed few or no signs of pathology or unusual treatment. These ABGs make up a small sample from a large population of canines: many were not recovered by archaeologists, damaged by redeposition or even lost in an archive. Yet even if the stories represent rare incidents, that abuse, care, and other events happened at all is significant. Human-dog interactions had a wide range throughout both the Iron Age *and* the Roman periods.

The textual evidence is replete with accounts of dogs in formal working roles, whether hunters, guardians of livestock or property. Interestingly, the stories show a different picture. Several of the dogs may not have worked in these occupations (or at all): CA-2 was likely a companion animal, OW-13 was unlikely a working animal given its condition and, from its health status, OW-1 may not have worked. Even CA-1, which was not guaranteed to be a companion animal, likely worked in other, less official, roles if at all. It may have been a 'ratter' or possibly a watch dog. Both of these functions do not appear in the texts. The latter is a distinct role from the guard described in Columella, who, from the description as 'of ample bulk with a large and sonorous bark… a squarely built dog' (Rust. 8.12.3), was clearly expected not only to alert their owners to intruders but bodily defend the property and attack assailants; 'frightening [an intruder] by barking and not allowing him to come any nearer, or, if he insists on approaching, they violently attack him' (Rust. 8.12.7). CA-1 was the size and shape of a Pomeranian. It would not have posed any grave danger to human intruders, nor would it have had a physically intimidating presence.

Thus, the stories show some congruence with the texts, but also some alternate, less formal, roles for dogs. However, this does not mean the texts were wholly inaccurate. Some dogs that did not feature in stories, such as GY-20 and DA-9, were likely working animals; both were large dogs with healed leg fractures, likely caused by an accident. The correlation between dog numbers and sheep numbers, in particular, suggests this role continued throughout Iron Age and Roman society. Conversely, guard animals are most difficult to find, both in the stories and the biographies from Appendix A. This does not mean that they did not exist. Large dogs were found in urban areas, and some of these animals may have been used to protect property and valuables. At any rate, GY-20 was unlikely to have guarded sheep.

Where texts and bones show possible agreement is that a dog's role could change throughout its life. While not written as a full story, OW-8's biography in Appendix A points to a dog that survived a serious injury, but may not have been able to work afterwards. Its humerus healed from a fracture, but left the dog with one front leg permanently shorter than the other. It may have had to 'retire', much like Horme did after her working life, to become a companion to Arrian. Overall, where the literary evidence, art and stories align the best are for the use of companion animals.

Some stories are dominated by a dog's role in death. HD-2's treatment after death was particularly dramatic, and, in association with its young age, suggests that it may have been killed for a specific purpose. SF-3's story presents a more balanced example. While the evidence surrounds its death is intriguing, and points to a kind of 'last supper' that was given to the dog shortly before dying, the dog may have also worked before during its life.

Whether the Iron Age and Roman dog stories represent two different groups in their origins, e.g. 'native' dogs vs 'new' dogs, is difficult to say. Of the dogs outlined in the stories, it is very likely that CA-1 and CA-2 were either imports or, more likely, descendants of imports brought to Britain post-Conquest. Lineages are entirely unknown for the other dogs. DA-6 is an exception. A unique dog in the Iron Age dataset, dogs this small were extremely rare in Late Iron Age Britain. It was almost certainly imported from the Continent, (or only one or two generations from a dog imported from the Continent). However, even the other Late Iron Age dogs could potentially have been brought from Rome. DA-6 is a striking example of an imported animal, but may not have been unique. The largest study of dog morphotypes of a Romano-British site, Vindolanda, indicates the fort had a diverse range of types. However, it is still very difficult to determine how many of these dogs had their origins in mainland Europe and how many were acquired from 'local' lineages. The smaller varieties and a few of the very large dogs are the only exceptions. However, given the Roman transmission of dogs indicated in the texts, the probability that some new medium and large morphotypes were brought to Britain is high.

But ultimately, what does all this say about human-dog relationships as a whole? Thus far, I have worked out how dog numbers varied across time and space, the state of health of a select sample, and the lives of a few individual dogs. I will now zoom out and look at the context of Iron Age and Roman Britain as a whole, and the major questions of how and whether Britons themselves changed.

Chapter 8: Canine Britannia

After a long trawl through all the data collected for this project: published report data, dog numbers across Britain, my own skeletal analysis and select Roman texts, it is now time to put all the results together and ask what they actually mean. What changed about dogs between Iron Age and Roman Britain, what did this mean for human-dog relationships, and what do canines have to do with wider questions on human identity in Britain before and after the Conquest? I will visit each of these questions in turn, interpreting the evidence and offering answers.

8.1. What Changed?

Change is perhaps the easiest question to answer, given that the main theme of Chapters 4-7 is to look for it in some way. Change through time, change through space, change in health and change in life stories. Put together, we may be able to see a lot of change. But do we? Between the Iron Age and Roman periods, dogs vary less than what may be expected. Compared to cattle, sheep and pig numbers, many of which have dramatic NISP shifts across some parts of England, canines change very little. They are present in all phases, from Early to Late Iron Age, and all regions of England. All settlement types have them, all settlement sizes have them, and all settlement forms have them. Dogs were everywhere.

So when we look at how they differ across all these varied times and places, the answer is not much. The median NISP ranges from only 1% - 2% (occasionally 2.5%) of the total. The upper quartile fluctuates slightly more: from 2.5% - 6%, with sites in the South, Early Iron Age and Late Roman periods tending to have higher values: the Late Iron Age and Early Roman periods show very little difference. However, even small differences may be statistically significant: that is to say, they are not due to chance. Yet the South, Early Iron Age and Late Roman periods show the only consistent differences from other phases and regions.

Dogs on different settlement types were investigated, in the form of both change through time and space. A particular point of interest was the urban-rural divide: given that urban and rural sites vary hugely in terms of their material culture, architecture and even bones for main food animals, dogs may have been approached differently in each settlement type. Only small numerical variations were found: urban sites were slightly more likely to have dog ABGs, and in several regions they had more dog NISP. Yet urban sites vary in size and importance, and rural sites cover a wide variety of sites from small farmsteads to villas. Thus, even when acknowledging the ambiguity of the divide and breaking down settlement types more, by looking at settlement form, size and whether villa buildings were present, the results were not hugely revelatory. Settlement form yielded no results. Whether a site was 'complex', 'unenclosed' or 'enclosed' made no impact on dog NISP or ABG numbers, throwing doubt on the idea that a complex site may have used them more than more simple farmsteads with few extra buildings. Settlement size had more effect but was inconsistent. When broken down by phase and region, some regions and phases had more dogs on large sites and some had more on small sites: statistically speaking, however, there was little effect. No clear pattern across time or space could be seen.

The impact of villa buildings on a site was equally questionable. To begin with, the dataset of sites with any villa buildings was small, particularly when divided by phase and region. Due to issues with the RRSP dataset, the specific site phases that were villas could not be narrowed down and the site in general had to be marked as such (even though many villas were built in the Late Roman period. Phases and regions varied hugely from one another: for some, sites with no villas gave the largest median and upper quartile for dog NISP, and for others, the reverse was true. Even when variable dataset per region and phase was accounted for, no notable pattern existed.

Other settlement types, such as hillfort, military and 'intermediate' nucleated sites had small datasets which limited the reliability of their results. The first two had patterns that were clearly different from other settlement types: hillforts had small numbers of dog NISP and a particularly small proportion of dog ABGs, but had a very high number of ABGs in total. Military sites, conversely, had fewer ABGs but nearly all were dog. Nucleated sites had similar trends to urban and rural settlements, and did not have a distinct pattern of its own.

All in all, the number of dog bones varied little. Yet some individuals were deposited and recovered whole: they survived as associated bone groups. A key difference may be whether whole dogs were deposited more or less frequently from one time period to another, but again, little difference was found. Although harder to statistically test, as many sites had no ABGs at all, only significant results between the South and other regions were revealed. Most site phases, if they had any ABGs at all, had only one and this had a good likelihood of being a dog. Very large sites, and datasets, had a greater likelihood of having one or more mixed assemblages of dog ABGs and other animals. But this did not appear to change much through the Iron Age to Roman periods, except for the South.

Subsequently, pre-depositional acts did not change much. Dog skeletons were slightly less likely to be gnawed by scavengers (likely other dogs) in the Iron Age compared to the Roman period, but the difference was statistically insignificant. Butchery was very rare in both periods, and only four Iron Age and two Roman ABGs were affected: most of marks suggest that the dog was being skinned, not defleshed for meat. The story of HD-2 being disembowelled is a unique one from my dataset. Other authors have noted case studies of dogs from British Iron Age contexts with butchery marks, and speculated that the practice may have been common during this time (Smith 2005: 19-20). However, these case studies may not necessarily represent most dogs, but unusual contexts that were singled out for study; on the other hand, 25 Iron Age ABGs in only the South East of England is hardly a wide enough dataset to state it was always rare in this period. The final question of whether dogs were butchered more in one time period or another, while looking unlikely, has yet to be settled for good.

One practice that shows clear continuity and change between the Iron Age and Roman periods are the places where dogs were deposited or buried. All Iron Age ABGs, bar one, were buried in pits. Roman ABGs were buried in pits too, but also many other types of context: quarry fills, features, ditches, and most interestingly, wells. Several authors note this choice of resting place, and discuss its possible ritual links with water (Cool and Richardson 2013; Hambleton 2006; Smith 2005: 51-53). A major question is whether deposit types were carefully chosen, or simply used due to convenience (and careless deposition), and if a change in deposit type thus signifies a shift in attitude. But this is difficult to tell. A major issue faced when linking the ABGs to their depositional context is the lack of dialogue between the main excavation report and the faunal section. The analyst may report an interesting dog skeleton, but frequently miss key context details or information, such as other animals or finds in the same deposit. Looking up the context number in the main report may indicate little further information about the skeleton. This issue has been noted by other authors (Hambleton 2008: 84, 98; Morris 2008: 370-72).

Most of the sites in this project had major limitations in the reporting of ABG contexts. Baldock's faunal report lacks context numbers to link with the main report. The Danebury Environs reports have inconsistent reporting of dogs within the main context plans, Danebury itself had little reporting on the contexts beyond simple type and many of the dog contexts in Owslebury were redeposited or damaged (Maltby 1990). Even the original reports of Greyhound Yard miss out key details on the dog burials (Maltby 1990; Woodward *et al*. 1993) that were only revealed in a later publication. Six of the ABGs from Greyhound Yard (GY-9, GY-10, GY-14-16, GY-21; see Appendix A) were buried in foundation shafts that were originally noted to be cess pits. Interestingly, this was a rather heterogeneous group of dogs. Five were adults, and one a puppy: the former ranged in size from 28-57cm. Two had lesions that may indicate minor injuries, and at least one dog had been left in an open deposit for some time before burial, as shown by signs of gnawing. As can be seen in Fig. 8.1, these dogs were deposited with more dogs, puppies, animals and various material culture. Overall, this indicates two possibilities: the most important being that at least some dogs were deposited in carefully chosen ritual acts that were specific to Roman Britain. It is possible that the number of dogs deposited this way are under-recorded, due to the aforementioned issues with reports. The other is that the dogs chosen for such deposits varied hugely in size, shape, age and health, even sometimes within the same deposit.

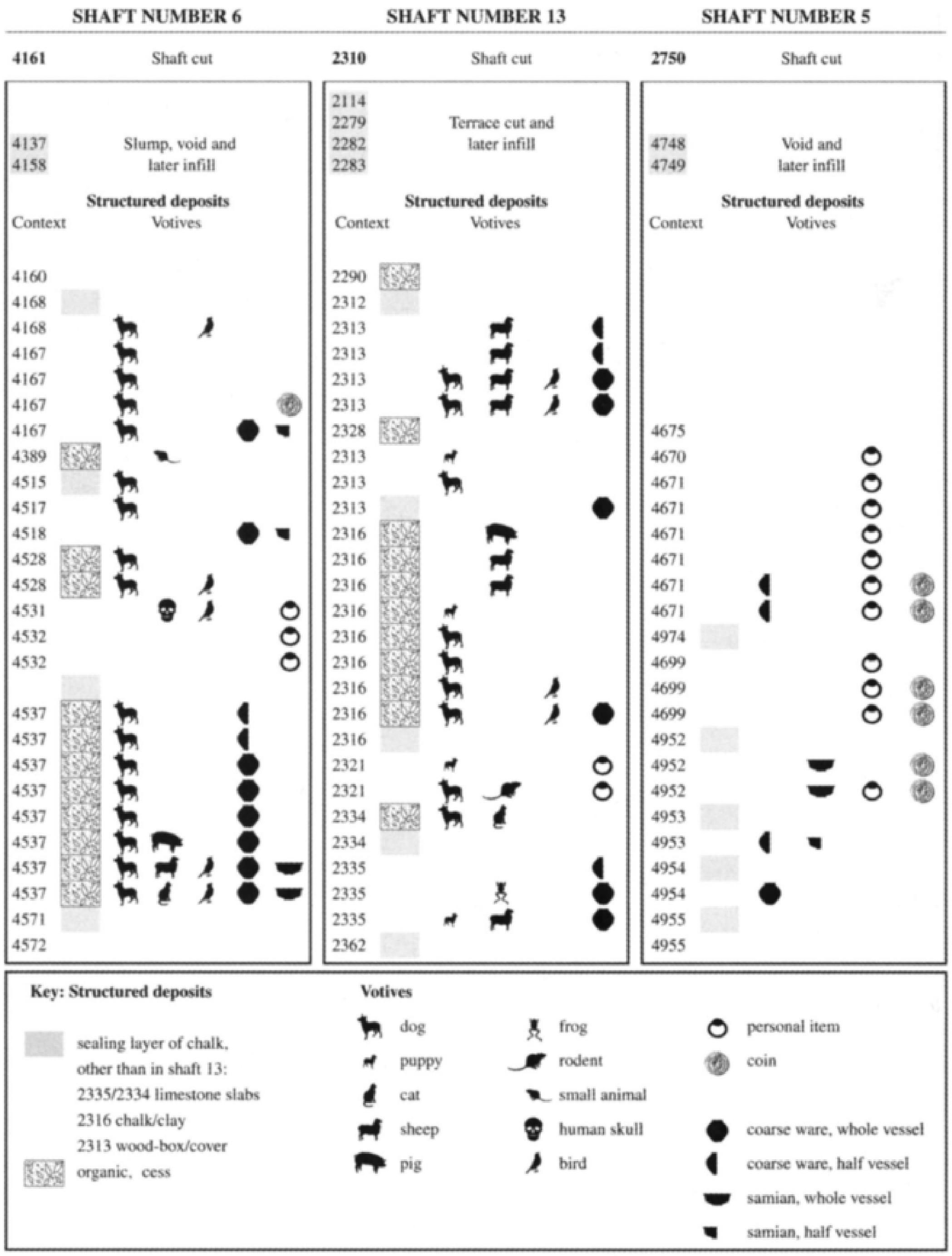

Fig 8.1. Structured deposits in foundation shafts in Greyhound Yard (Woodward and Woodward 2004: 75).

Iron Age ABGs were generally more complete than their Roman counterparts, and were particularly likely to have smaller, more fragile bones survive. This was a statistically significant difference. Yet no differences in gnawing exist, which may be expected if one set of dogs were deposited more carefully than the other. More care would imply swifter burial in an individual plot, thus reducing the likelihood that scavengers could gnaw on the remains.

Perhaps the Iron Age ABGs were more likely to survive: but because of more careful recovery or better survival after deposition happened, not different deposition practices. Or maybe the Roman dogs were less well recovered. Much of the Roman data came from two large sites, Greyhound Yard and Owslebury, and the former had far poorer survival than other Roman sites. A piece of data that may help settle this question is whether the dogs were buried singly, or deposited with other animals, albeit whole. But, as I discussed in Chapter 4, this could not be collected: too many sites had fuzzy information about their dog deposits, or had known issues with redeposition or crushing of contexts from later ones placed above.

The strongest, and least ambiguous change between dogs in the Iron Age and Roman period is their morphology. Roman dogs come in all shapes and sizes: very large, medium, small, tiny, and from robust to slender builds. This does not mean that Iron Age dogs had no diversity, but it was much more limited: nearly all were medium-sized or large at 42-56 cm withers height. Particularly robust or slender builds were not present. The only exception was a dog (DA-6) dating to the Late Iron Age that was 31cm in height and suffered from chondrodystrophy.

This change has been discussed and debated by other authors: as mentioned previously, Harcourt's study of individual dog bones from the Neolithic to the Medieval period shows an increase in size diversity in the Roman period, particularly for small dogs (1974: 159-166). While Clark has challenged this, and noted the existence of a few small dogs from the Late Iron Age, these are both few in number and date from the later part of the Iron Age when trade with the Romans occurred, whether directly or indirectly (1995; 2000:

168). Some Roman dogs, or their ancestors, are highly likely to be imports from the Roman mainland, trend noted elsewhere in the Empire (Bartosiewicz 2000; Colominas 2016) and a possibility I elaborate on in 4.4.

If new dog morphotypes were brought to Britain from other parts of the Roman Empire, then a key question arises: how many dogs across Roman Britain had ancestors from Iron Age Britain, and how many from mainland Europe? Unlike animals and plants that were newly introduced, such as fallow deer, dogs already existed in Britain before the Conquest and had reasonable size and shape diversity. Many dogs from the Roman ABG dataset are the same size and shape as the Iron Age group. Were all of these dogs traceable back to the Iron Age, and only small types imported, or did a blanket replacement of dogs happen?

As I discuss in 4.4., several sources state that dogs were exported from Britain for use in hunting, and that they were seen as particularly desirable, even if only for their exotic status. Presumably this would mean they were still bred and kept in Britain. Given Roman Britons' ambiguity about Roman imperialism and new material goods (a quandary considered in 8.3), it is likely many people would have continued to use and keep dogs that were familiar.

But, as shown by selective breeding over the last 150 years, dog lineages can change very quickly. A 'traditional' dog from the Late Roman period may have had some or all ancestry from another part of the Roman Empire. It could be argued that, past a point, a dog's ancestry did not matter at all, only human views on it and how that view affected relationships with the dog in question. Given the huge range in dog sizes and shapes, the difficulty in finding distinct morphotypes (illustrated well in Bennett *et al.* 2016; Bennett and Timm; 2016), the only way to be certain of a dog's origins is the collection of genetic evidence. Used mainly to determine dog domestication over the past c. 15 000 years and where it originated (Larson *et al.* 2012), looking at a smaller timeframe and geographic range may be more challenging, but is theoretically possible.

At any rate, the point is that how new morphotypes were incorporated into Britannia is important, at least for the earlier part of the occupation. Importing select types of dogs, but keeping mainly indigenous varieties, has far different implications to new dogs completely replacing the previous population. Of course, intermediate options are always possible, and both populations may have interbred as well. For now, all that may be conclusively said is that some morphotypes, at least, were new, and that indigenous varieties may have been too valued to replace entirely. This has important implications for Romano-British identity and relationships with dogs, particularly when considered in relation to health and welfare.

8.2. Human-Dog Relationships, Before and After

Change is not interesting simply because it happened, but for what it means. All the shifts (or lack thereof) outlined previously may be the result, or cause, of changes in the ways people and dogs interacted with and thought about one another. Being a very complex question, there are many lines of enquiry to follow. A line that has been followed only briefly in this project is the use of art and material culture to examine human attitudes and thoughts about dogs, in favour of prioritising biological evidence.

On the surface, dog numbers changing a little or not at all may be taken as a sign that human-dog relationships barely changed in terms of the number of day-to-day interactions: people would not have suddenly found themselves face-to-face with more or less dogs than before. If anything, this would have happened more within the Roman period, given the rather modest rise later in occupation. But this may not be all there is to the matter.

Frequency of human interaction would have depended on the dogs' place in society and what they were doing most of the time. If dogs were stray, pariah or feral, they would have had less interaction with humans than those with owners and possibly a distinct role. This is a quality that may have changed through time, independently of dog NISP. However, the number of dogs that were strays or feral is nearly impossible to ascertain. Perhaps ABGs may be expected to fall in the time and place where strays were more common. Although even this potential trend is uncertain: stray dogs may still be suitable for use in particular ritual activities, such as burying dogs under building foundations or in pits and wells (Chadwick 2015; Hambleton 2006). Yet use in ritual activity may not be enough to make up the shortfall: it depends largely on the context in which most dogs are deposited as ABGs.

Health and Human-Dog Relationships

Another means of finding potential changes in the number of stray or feral dogs is to look at pathology. Dogs that had no owner may be more vulnerable to abuse and disease, and a population with many strays may see higher frequencies than one that has few. Yet when the Iron Age and Roman ABGs are compared, very little difference in trauma and infectious disease exist. Most difference is in congenital issues, which are accounted for by the high number of small morphotypes in Roman Britain. Overall dog pathology numbers appear stable through time, implying that the frequency of human-dog interaction remained the same as a whole, and perhaps varied slightly between regions and within the main phases.

One of the most striking indications of poor human-animal relationships is abuse: namely, trauma that is unlikely to have been caused by an accident. Fractured ribs, blows to the skull and trunk fall into this category (Munro and Munro 2008: 31-41). Yet these are rare. One striking case of a skull fracture presents in a Roman ABG from Greyhound Yard (GY-7) and a couple of other dogs, in their stories or biographies, show rib and spine lesions that were likely caused by trauma. But these represent only a small number of the total ABGs, around 6%. It is entirely possible that poor treatment, e.g. soft tissue injuries, can happen and not affect the skeleton, but these very low rates suggest that abuse was low even when taken into account, especially when compared to case studies in other time periods and locations (Teegen 2005; Udrescu 2005).

Welfare is about more than abuse. Dogs may be afflicted by other issues throughout their life other than abuse: age-related pathology (arthropathy), accidental trauma and congenital issues present from birth. These problems, while less dramatic than abuse or care, can give valuable insight into human-dog relationships. Arthropathy, most simply, can suggest how long a dog lived for. For groups of dogs, this type of lesion can suggest if one group had a longer average lifespan than the other. But in the case of the Iron Age and Roman ABG groups, both had similar frequencies of arthropathy: just under 25% of all ABGs were affected. At least a quarter of all dogs in each timespan then lived, if not to old age, at least a few years into adulthood. Quantifying the exact age of death, and why the dogs died is impossible, but at least suggests that dogs were not intentionally culled any more or less often in one period than another. Essentially, continuity reigns. Differences in tooth wear, given the similarity in arthropathy, may instead support the stable isotope evidence that dogs in the Iron Age had a poorer, less protein-rich diet.

Accidental trauma can happen both during and outside of work. Yet, as with arthropathy, total trauma frequencies did not vary between the Iron Age to the Roman ABGs, averaging at just under 30% of all ABGs. Most of these lesions were likely accidental, and so other causes did not appear to vary. The main two, discussed thus far, have been the use of dogs in working roles and accidents from urban hazards. If one were more responsible than the other, then large differences between trauma on Roman rural (where known working roles would have been carried out) and urban sites would be likely. Only 3% difference exists between the two. Nor is there much difference between Iron Age or urban and rural contexts.

So either dogs were equally prone to urban scrapes and rural job accidents, or they were prone to neither. Perhaps dogs just get into accidents even if not directly working for humans, and perhaps the danger of towns has been exaggerated. Most lesions classed as traumatic in origin, after all, were quite small and unlikely to have been caused by major, life-changing events. But there is another factor to take into account. Dog numbers have a moderate-to-high correlation with sheep numbers, and a small correlation with wild animal numbers (see 5.3.1). Thus, it is very likely some were being used to guard sheep, and likely they were used to hunt wild animals at least in some parts of Britannia. These duties likely resulted in accidents and mishaps, but what is important is that the use of dogs in this way changed little through time. The only small change to note is that the correlation between dogs and sheep increased slightly over the Roman period, suggesting perhaps a modest rise in the number of dogs used for this purpose at most.

Congenital conditions, as mentioned earlier, happened much more frequently in the Roman period. The group is linked very strongly with small size, with many conditions such as chondrodystrophy (causing disproportionate dwarfism), tooth crowding and absence of the third molar presenting in small dogs. Their rise, therefore, suggest a greater acceptance of dogs outside of traditional roles and sizes. The presence of few small dogs in Late Iron Age contexts and the one in my own dataset, DA-6, suggest that a few were imported for reasons unknown. Yet it is interesting that numbers did not rise dramatically during this period. It is possible that the Roman invasion was a catalyst for the adoption of small dogs, both from the small stock already present in Britain and brought in from outside. That they are found nearly everywhere in Britannia, from North to South, small farmsteads and urban places (Bellis 2018), and even military sites (Bennett and Timm 2016), supports this possibility.

Lack of care, abuse and health problems are easier to find than good treatment (Thomas 2017: 181-182), but care and positive human-dog relationships can be unearthed through more general signs. Sykes found changes in diet between dogs in Iron Age and Roman

Britain; the former had diets that were, on average, less rich in protein and thus poorer quality than Roman dogs (2014: 142-43). Textual evidence, covered in 5.4, suggests that some dogs at least were highly regarded and cared for. An attitude not exclusive to small dogs, Arrian's account of his hound Horme suggests that working dogs may have fit the bill too (*Cyn*. 5.1-6). The question that always remains is how relevant these texts are to people in Roman Britain, given that they depict elite Romans. But given that some well-heeled Romans spent time in Britain and were prominent members of urban communities and estate owners (Mattingly 2006: 372-73, 465-66), it is conceivable that their attitudes were shared with some social groups in Britannia. Their responses may be investigated using pathology, which can offer clues about the level of influence from the Continent, but not as single lesions: a full biography of an animal shows how lesions may have affected one another, or other attributes such as the age and morphology.

The ABGs I created biographies from lived quite different lives from one another, showing the range of human-dog relationships possible. On one extreme, CA-2, one of the dogs from Caistor, had the richest diet of all Roman dogs and evidence of being cared for during a serious fracture. On the other, GY-7, from Greyhound Yard, had a skull fracture that was almost certainly not accidental. Even though it may have been from a human acting in self-defence or animal-inflicted, the injury is likely to be from abuse. Most others do not show signs of abuse or care, but have another distinguishing feature: unusual deposition, recovery or systemic disease or anomaly.

Yet most of the exceptional or unusual biographies, particularly those depicting care and abuse, are from Roman contexts, not the Iron Age. Interpreting this difference is challenging: while Iron Age dogs had a smaller sample size, they were generally better preserved than their Roman counterparts. So while the chance of finding a dog with abuse or care is lower, any unusual experiences in the dog's life would, on average, be easier to find. Thus, it is possible that Iron Age dogs had a less close relationship with humans overall, meaning they were less vulnerable to both abuse but less likely to be cared for. The poorer quality of diet for Iron Age dogs may be explained by this pattern.

Still, the idea is very tenuous. Biographies have the power to show individual human-animal relationships in a high level of detail but they have a major weakness. How typical are they? This does not only apply to my own ABGs, but those from other studies. MacKinnon and Belanger's dog from Carthage shows an ill, but well-cared for animal that was fed and cared to compensate for a lack of teeth and arthritic hip (2006: 42). Several of the Greyhound Yard dogs were deposited carefully in pit shafts (Woodward and Woodward 2004). But this does not mean that all dogs were lovingly cared for or buried with some specific purpose in mind.

On the other hand, it does not necessarily follow that all disarticulated dogs or ABGs with little distinguishing features were not cared for, and that the cases shown above are unique. If the dog population of Britain is visualised as a jigsaw, then we only have a few pieces. The other pieces may follow a similar pattern to the ones we have, or a very different one. But even if the biographies are exceptional, and are different to all others in Iron Age and Roman Britain, they at least suggest that specific behaviours – e.g. abuse and care, happened at all.

Deposition and Human-Dog Relations

One practice, the deposition of dogs, can suggest human attitudes towards the animal buried. Very unusual burials are well known, from not just the Iron Age or Roman worlds, where dogs were buried with grave goods (Robertson 1982; Collins 1990) or even in a large 'dog cemetery' for their exclusive use (Stager 1991). In this dataset, however, only a few dogs had unusual burials and some may have been deposited in middens with other animals, albeit whole. Attempting to tell any shift in attitudes towards dogs through time is impossible, except for the small possibility that depositing dogs in contexts other than pits, from the Roman period onwards, was linked to less care with burial (or some shift that made it desirable). In particular, the well burials may be linked with ritual ideas about dogs in association with water (Crease 2015; Hambleton 2006), but they are still uncommon relative to other ABGs. Otherwise, there are no other links between deposition context and other factors, such as a sign of change in ritual practices. Otherwise, similarity between the two periods is the norm. Butchery was rare, signifying that dogs were seen as different from other domesticates in most, if not all situations. The few examples of butchery found may have had special circumstances, often linked to removal of the pelt, not defleshing for meat.

Dog Roles and Human-Animal Relationships

A dog's occupation probably influenced its relationship with humans. Some dogs, such as CA-2, may have been exclusively companion animals. The combination of a rich diet, signs of care and indoor life suggest the dog spent considerable amounts of time with an owner/s. Others may have worked as guards or hunters. GY-20, OW-8 and DA-9 (see Appendix A) are candidates for these roles, given they were medium or large dogs, with traumatic injuries that were likely caused during an accident. However, these signs are no guarantee they were working dogs. Stray or feral dogs may be injured, and companions can also get into scrapes. Dogs with no traumatic injuries may have worked as guards or hunting animals; they may have been fortunate enough not to be injured, or died young. This ambiguity is illustrated in GY-7: it may have been a guard dog injured by an intruder, a hunting animal attacked by its quarry, or an abused stray. It may even have been a companion attacked by a person other than its owner.

However, deciding which dogs were companion and working animals is an exceptionally difficult task: one that would be challenging even in a large dataset. Attempting to do so would require extra data collection, such as carbon and nitrogen stable isotope analysis, for each dog. Even with extra data and a larger sample, however, there would be uncertainties. While a high-quality diet may indicate a companion animal, and traumatic injury may indicate a working animal, the two properties combined does not guarantee a combination of roles. Put simply, the companion dog may have suffered an accident. Alternatively, the working dog may have been fed particularly well, perhaps because its owner was affluent.

Nonetheless, the possibility of multiple roles is real. No evidence strongly suggests that dog roles could not overlap. On the whole, it is likely that a number of dogs in Britannia guarded livestock, others guarded property (particularly in urban areas) and an uncertain number were part of the chase. The latter were probably more common in military settlements. At least a few canines, perhaps more, served as companions. The number of strays is much harder to estimate, but it is probable that a least a small portion of the total population had no owner. Urban areas may have had more stray/feral dogs, given the larger density of human settlement, and thus the greater potential for food to scavenge. But it is impossible to be sure.

How did these roles change between the Iron Age and Roman periods? Hunting dogs may have increased post-Conquest, particularly in areas with a large military presence. The specific types used to hunt may have changed too but would require techniques, such as geometric morphometric analysis, or ancient DNA analysis, to confirm. Livestock guardians may have increased by a small amount, perhaps unevenly across the province. No direct evidence exists to show change in guard dogs (given their lack of correlation with other animals), but their numbers may have risen in new urban settlements. Inhabitants may have wished to protect against theft in densely-populated settlements.

Change in companion animals is more tricky to find. The dietary improvements and spread of small dogs, post-Conquest, suggest some increase in companion dogs while the pathology evidence indicates little to no change. Overall, perhaps a modest rise in dogs kept for companionship occurred, particularly in towns. The idea of which dogs would make suitable companions may have adjusted in favour of small dogs, although that may not have precluded larger dogs being kept for the purpose. However, some dogs had no role at all. How these changed through time is even less certain; strays or feral canines may have risen with the establishment of urban centres, but this is a fairly tenuous suggestion.

Ultimately, the difficulty in seeing change in human-dog relationships before and after the Roman Conquest may be a sign that continuity was maintained. Many other zooarchaeological studies of animals find dramatic changes across time and space: introductions of new animals, animals in unexpected places, and huge dietary shifts (e.g. Minniti *et al.* 2014; Sykes *et al.* 2006). The studies of diet in Britannia show clear changes from mostly mutton to beef and pork in many parts of the province (King 1999b; 2001). By comparison, the changes noted here are very small, and the subsequent changes in human-dog interactions rather modest. Given the dramatic shift in morphotypes, particularly small dogs, and possibility that many dogs in the Roman occupation may have come from the Continent, replaced and/or interbred with indigenous varieties, this lack of change in human-dog relations is initially surprising.

But perhaps it is less puzzling when considering the identity of the people living under Roman occupation. The way in which people think about and interact with animals is linked to their own identity, and Britannia was a place where many people had mixed responses to living in the Empire. These responses may have had close ties to the way they treated dogs.

8.3. Discrepant Canine Identity

The Roman Conquest went beyond merely introducing new material goods, architecture, flora and fauna to Britain. People's lives, and identities, were irrevocably changed. Yet unlike the simplified models of Romanisation, each individual Briton was affected differently. How they were changed by the Conquest depends on where they lived, what groups they belonged to and even when they lived: Britain changed in the three and a half centuries it was under imperialism. This model, summarised best as 'discrepant identity', attempts to find the effect of Roman imperialism on behaviour and material culture (Mattingly 2006: 17-18; 2011: 14, 216). Given that no individual interacts with dogs quite in the same way, and their attitudes may be affected by various social groups, local and more broad, the model is an ideal lens for studying dogs and their wider links to Roman imperialism. It would greatly benefit from a slight widening to incorporate flora and fauna more thoroughly.

Most of the archaeological evidence linked with discrepant identities, thus far, are buildings and various types of material culture. Present study produces very interesting contrasts between different categories of artefact: for instance, despite both having religious functions, inscribed altars are far more common in the north of England and Romano-Celtic temples in the south (Fig. 8.2; Mattingly 2011: 224-225). Different communities clearly preferred and adopted, or were made to adopt, different aspects of Roman material culture.

FIGURE 8.5 Distribution of Roman inscribed altars in Britain.

FIGURE 8.6 Distribution of Romano-Celtic temples in Britain

Fig 8.2. Difference in distribution of inscribed altars and Romano-Celtic temples in Britain (Mattingly 2011: 224-255).

The change in diets across Roman Britain has been extensively studied (Allsop 2014; King 1984; 2001) and this, at least, has been revisited briefly by discrepant identity to show regional adoption (or lack thereof) of cattle and pigs (Mattingly 2006: 474-75). Hunting activity has been given a cursory glance from Iron Age to Roman Britain, but otherwise animals, particularly live ones, have under-featured sorely in questions of identity. Yet if material culture has significant links to human identity and behaviour, surely living beings have just as much? Or more?

To begin with the most commonly studied animals: cattle, pigs and sheep, King's triplot maps are an excellent visualisation of how the relative numbers of each change throughout the Roman period, and just how discrepant the variation is. Military sites have a much greater preference for beef and pork, while urban sites have a moderate preference, depending on the region they originate from. Rural sites vary widely from one another: some show almost no change from pre-Roman proportions, and others shift to a new pattern (Fig 8.3). Clearly, the behaviour of Britons in this specific area were affected by a number of factors: regional groupings, local issues, supply and demand, and the last factor: power. Power is more obvious when examining military action, but as noted by Mattingly, is a vital component of any conquered people's identity and behaviour (2011: 206-207). People may have been compelled, or heavily 'encouraged', to produce specific food for local elites or urban centers (Thomas and Stallibrass 2008: 1-2).

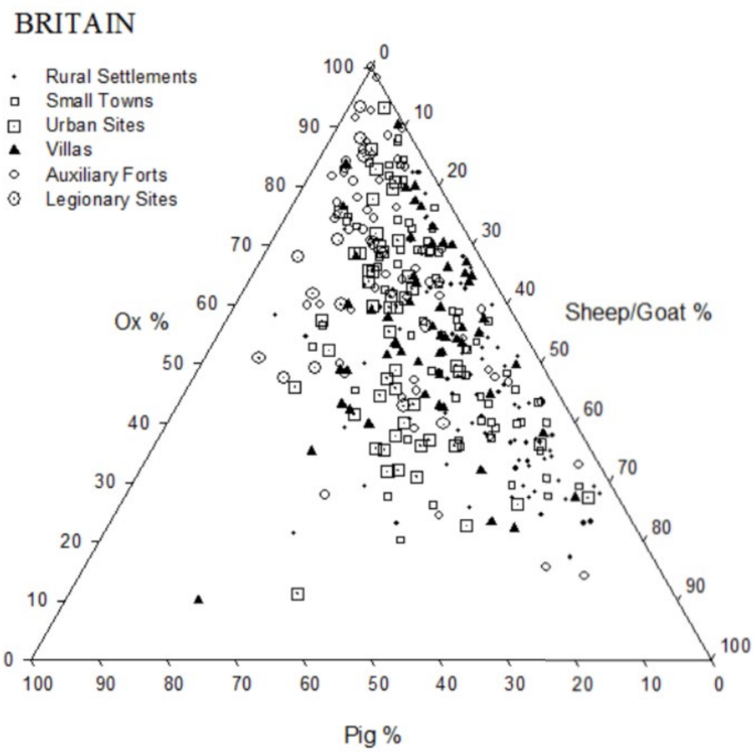

Fig. 8.3. Triplot diagram of relative cattle, sheep and pig numbers between site types in Britain (from King 1999b: 183).

Dogs fit this pattern somewhat differently. As animals that are not measured against other animal numbers, and not usually eaten, canines are unlikely to be bred less in favour of other animals or as a response to dietary demands. Their numbers, however, may rise or fall based on cultural attitudes towards them and their perceived utility and value. Dogs not valued for work roles may be expected to be kept less, unless they were prized for other reasons, perhaps sentimental. The effect of imperial power is difficult to discern, as dog numbers vary little throughout time and space. Even if it did, there may be less of an argument for involvement in the breeding and adoption of particular types of dogs, as typically this benefitted only the owner, unlike the production of food products for others.

However, dogs can be measured against other animals in some contexts. Dogs and sheep are particularly worth studying, given the recommendation that the former be used to guard the latter in Varro and Columella (cf. 5.4.1). The link appears to be a strong one both before and after Roman imperialism, with only a modest rise through time. No regions or time periods have low correlation, except possibly the East (with a small sample size), so except from perhaps remote communities, little discrepancy exists in Britain in this regard. Dogs, however, were not universally adopted for this purpose, but the practice appeared to continue from the Late Iron Age. Perhaps Iron Age British and Roman attitudes were too similar for any change or influence to happen.

A few dogs may have been tied to the identity of hunters in Roman Britain, as shown by the mosaics found in villas and townhouses (cf. 4.4). Military populations in Vindolanda were noted by Bennett and Timm to have a number of dog morphotypes that may have been used in hunting (2016: 121), and my project has found a larger correlation between dogs and wild animals in regions where forts were common. However, it is interesting that this link did not spread or become widely common. The practice was evidently discrepant, tied to specific groups.

More generally, limited regional discrepancy in dogs existed. By and large, all regions had plenty of dogs and ABGs, and similar correlation with dogs and sheep, and dogs and wild animals. Dogs made up more of the total ABGs in the East ABGs than other regions, particularly the North East where average percentages were lower. The reasons for this are ambiguous: either a preference for depositing dogs whole over other animals, or a lack of interest in depositing other animals whole. Either way, a slight regional discrepancy is present, perhaps a reflection of old, pre-Roman social groups, ties and practices.

Aside from numbers, how deposition practices relate to discrepant identity is difficult to determine. Regional difference cannot be discussed here as the ABG data for the East is too small. The greatest difference is between the Iron Age and Roman periods wholescale, at least in the South: dogs were deposited almost exclusively in pits in the former, and in several context types in the latter, including ditches, quarries and wells. As the change is universal, and appears immediately after the Conquest, there does not seem to be any discrepancy between places in this region. Practices may be different in others, however.

Otherwise, lack of change in dog numbers between the Iron Age and Roman periods indicates little wholescale *quantitative* change across Britain. Change in this regard seems to be more within the Roman period, not between it and the Iron Age: if the numbers of dogs are linked to cultural identity, it is a quality that changed to a small extent throughout the Roman occupation, and not due to the Conquest. However, there are other important ways in which human-dog relationships could change.

Between the main settlement types in Britannia, there are both common and contrary factors. Dog numbers, as discussed, had little overall difference except for slightly higher amounts (NISP and ABG) in urban settlements. By contrast, the pre-Roman hillforts had similar numbers of dogs to contemporary sites but more ABGs of other animals. The most striking difference is in terms of dog types. Urban settlements had more small dogs (41% of ABGs) than rural (25%), a trend also noted in previous research (Bellis 2018: 107). More interestingly, very large dogs are more common on urban sites than rural as well. But it is still crucial that small and large dogs were present in both places. Even if urban and rural dwellers had different reactions or attitudes to new dogs, or kept particular types in relation to their cultural identity, they were not so different to stop rural dwellers keeping them at all. Practical considerations may even have influenced the decision over which dogs to keep.

A prime area for discrepant identities to be expressed between places is in human-dog relationships. People in different places, and with different levels of Roman influence and reaction to it, may have had rather different interactions with dogs. But even this question brings vague answers. Urban and rural places may have had different relationships with dogs overall: initial studies in a pilot support the possibility, as urban dogs had more fractures and rural dogs more lesions related to arthropathy (Bellis 2018: 105-106). But the dataset from this project gives rather different results: the urban sites analysed here have little pathology difference, except for congenital lesions. So a small discrepancy may exist: urban sites may have preferred small and very large dogs, but they were otherwise fairly universal.

All in all, the various groups and communities of Roman Britain have less dramatic differences in how they keep dogs than other domesticated animals. The major change is how readily rural and urban places adopted new dog types, but even this has a lot of overlap. Small rural settlements sometimes kept small dogs (Bellis 2018: 107). A few other differences are possible: military sites in the North East may have kept dogs more for hunting than other settlements and regions, but need more data to ascertain. Other changes appear to be uniform, and not variable between different places and groups, such as the contexts where dogs were buried. Roman Britain, at least in canine terms, was less discrepant than we might think.

Chapter 9: Closing the Box

9.1. Everything Changes, Nothing Changes

Dogs were popular in all places and regions across Iron Age and Roman Britain. They did not tend to cluster in, or be absent from, any particular location or region. A slight preference for them in urban places, the South and the Late Roman periods are the only variations of note. If anything, dog numbers changed more *within* the Iron Age and Roman periods, not between. But the dogs themselves changed. Smaller morphotypes, and a few more large dogs were found post-Conquest, in a similar pattern to other Roman provinces.

The stories of dogs, explored through biographies, do not differ massively between before the Conquest and after. Both show a huge range of lives, from care to abuse and many other interactions with humans. Of course, reactions to new dogs and changes in attitude may go beyond lesions that appear on the bone. Sykes showed that dog diets generally improved in protein quantity between the Iron Age and Roman periods (2014: 142-43). Use in working roles changed slightly through time for medium and large dogs: more were likely used for herding sheep, and in the North East in particular, more were utilised for hunting. Small dogs may indicate a rise in canines kept solely as pets. But larger animals may be regarded as both working animal *and* pet pre-Conquest, and small dogs may have been used as ratters or small watch dogs. However, the small dogs studied here broke bones and experienced traumatic injuries, such as their larger counterparts did. Disease in general did not change through time aside from congenital anomalies such as chondrodystrophy, associated with the new small dogs. Whatever change in attitudes that *had* occurred was not reflected in the physical welfare of the dogs.

When exploring how reactions to Roman imperialism differed amongst social groups, dogs were not a vehicle for expressing difference as diets, architecture and material culture were. Effectively, Britons kept new dogs but treated them much the same as before. They kept them at the same frequencies as they did pre-Conquest (with towns a possible exception) but buried them differently when they died. This suggests that most change was internally driven. A top-down change in human-dog relationships would have likely seen large differences in how dogs were treated and the numbers at which they were kept, alongside areas where new morphotypes were unknown. That small dogs were found in many different site types, not just urban locations, suggests that people were keen to acquire them.

That most change was internally driven does not preclude human-dog relationships varying slightly throughout Britannia. Perhaps urban dwellers had a slight preference for small dogs, or were more likely to see them as fitting animals for more 'cosmopolitan' groups. Military sites may have had a preference for depositing only dogs as associated groups of bones, compared to other settlements which deposited a wider range of animals.

Why aspects of human-dog relationships remained the same is just as interesting as why others changed. There are two possible reasons: widespread resistance to Roman ideas about dogs, or too much in common for fundamental change to happen. The texts hint at the second possibility, with dogs traded between Britain and mainland Europe before the Roman Conquest. What little comparative data that exists also points towards this, with dogs across the Mediterranean showing similar lesions (and signs of care) to the dogs in Britain. Thus, dogs may have been a 'bridge' between quite disparate cultures, and a shared interest between Britons and Romans.

To return to the main research question, human-dog relationships changed between the Iron Age and Roman periods. This change, however, was not fundamental. The core aspects of human-dog relationships, including overall dog keeping, health and welfare, remained the same. Changes that did occur were relatively superficial, despite their dramatic effect on the archaeological record. This contrasts with the data on animals eaten, which suggests localised regional and site patterns that may have reflected local resistance to Roman preferences. Thus, studying living animals is not only important for understanding human-animal social relations, but can also reveal the impact of imperialism and how disparate cultures viewed one another. Sharing attitudes about a common animal may have served to reduce the perception of difference between conqueror and conquered.

9.2. Building the Jigsaw

If research is a jigsaw, I have managed to add several pieces to a gap-filled puzzle started by others. The first piece connects to the general proposal that dogs changed greatly in size and shape when the Romans invaded Britain. From the ABGs studied here, it is increasingly likely that the Conquest triggered a rapid expansion of previously-rare or unknown morphotypes that likely had their origins in the Continent, just as in other provinces (Bartosiewicz 2000; Colominas 2016). I also support the evidence that Iron Age peoples had contact with Rome pre-Conquest through animals: the small dog on Danebury was unique in this dataset, and given its similarity with post-Conquest chondrodystrophic dogs, may have been imported. This also raises intriguing question about what dogs meant for Iron Age peoples, in terms of status and identity, *before* the Romans invaded. We could apply a similar question to many other aspects of Iron Age and Roman life.

Several other, larger pieces, add context elsewhere in the puzzle and fill out the bigger numerical changes across Britain during the Iron Age and Roman period. Although Morris has investigated ABG numbers over IA and RB, the study was very broad in scope, running from Neolithic to Medieval periods, and was unable to break down the two periods into phases for more detail. A straightforward contribution to the puzzle is in terms of new datasets. 85 ABGs, examined in detail, form the largest standardised dataset of individual dogs in Britain and likely Europe. The secondary data incorporates NISP and ABGs across the entirety of England from both established datasets and individual reports. At over 400 sites in total this is, again, another significant contribution.

Studying health has usually taken the form of an ‘interesting specimens’ approach that produces intriguing, albeit fragmented research. Yet, using a systematic approach on a large number of animals, I have shown it is well worth carrying out research on the *population* level. The pieces of Chapter 6 have been able to place others’ research into a bigger picture. I indicated how dog health changed through time overall, not just for one or two unusual specimens. Indeed, many dogs, about half, did not have pathology at all. Others had small, easy to miss lesions.

Using bones *and* some texts shows the value of interdisciplinary work. Even though many texts were produced far from Britain, by a small group of people, some parts can offer small glimpses into exchanges and attitudes from further afield. Putting together different scales and types of evidence for faunal data is also invaluable, from ‘big’ data to very select stories. And a few pieces may be added to the puzzles of other disciplines. An extra dimension to debates on human identity and cultural assimilation in Roman archaeology, particularly Roman Britain, have been revealed. Animals that were not eaten or reared for others have the capacity to illuminate how living as part of an Empire may, or may not, have changed different groups of people. Human-animal studies, currently focused on recent rather than ancient history, may also benefit from these ideas.

Incorporating Morris’ ideas of animal biographies (2011) has allowed me to devise a working model. Even though the method will likely undergo future changes and additions, the power of its first iteration is impressive, and gives more insight into the lives of individual dogs than most other studies. Even works that focus on one dog, and provide a detailed biography, are limited to that one canine: this method may be applied to many animals, in both a more technical and literary form. Indeed, the value of stories in archaeology is immense, for helping us relate to our subjects. I have been able to compare the relationships between dogs that may have had deliberate harm inflicted e.g. GY7, against dogs that were likely cared for such as CA-2.

But the puzzle has many missing pieces, and is nowhere near a complete picture yet. How can future research build upon the work here, and fill some of the gaps? Two methods, stable isotope analysis and genetics, can build greatly upon this project. Genetics may help settle the question of just *how* many dogs were imported from the Continent, and how they spread throughout Britannia. Beyond small varieties, it is possible that some areas of the province adopted new dogs more readily than others.

Stable isotope analysis had already been carried out on several of the dogs in the ABG group. Two of the key dogs I wrote stories on, CA-1 and CA-2, had much richer stories for the extra data provided on their diets. Now imagine if the same analysis were carried out for all the ABGs: the potential is huge. Not only could animals' health be compared against their diet on a large scale, but stories and biographies with unusual features could be placed into context. If, for instance, the dog with the skull fracture (GY-7) had an excellent diet that was better than other dogs, it could raise further questions about how and why it was injured.

The method is not only valuable for understanding diet, but could be used to pinpoint just when dogs were imported. Strontium and oxygen isotope analysis could be used to find first generation imports, as with Madgwick *et al*'s study of fallow deer (2013). Indeed, several of the dogs in the sample would be ideal candidates, particularly those from the Late Iron Age or Early Roman periods. Knowing more about the timing and scale of dog importation would help refine questions about when and how human-dog relationships may have changed.

Yet the study of Roman dogs need not remain only in Britannia. Although studies of other provinces have been undertaken, more detailed ABG study of canines both before and after conquest would be valuable. Such work could help us understand how Roman expansion changed attitudes towards dogs on a larger scale, if it did at all. Closer to home, a few focused studies in the same area would help flesh out some of the more tenuous conclusions. Further work of less common settlement types and regions, both of published materials and ABGs, would allow for better comparison with others. Military sites and those across the North, in particular, desperately need more work beyond the fascinating but isolated site of Vindolanda. More precise morphometric work, perhaps even geometric morphometric analysis (GMM), would be valuable for revealing how much dogs of the same size differed pre and post-Conquest (e.g. Grossi Mazzorin and Tagliacozzo 1998). Skull and snout shapes are particularly lacking. This research need not necessarily be of ABGs, as a larger dataset from a wider geographical range may be more illuminating. ABGs, both in this dataset and in others, would benefit from more detailed analysis of unusual lesions, using methods such as X-ray analysis, computed tomography imaging and histopathology (cf. Janeczek *et al.* 2019).

More generally, dog numbers in large datasets would benefit from the use of Bayesian statistical methods. Compared to classical statistics, Bayesian statistics is better equipped to assess the *probability* of a hypothesis, rather than only rejecting or failing to reject it using a p-value. This may be valuable in future studies of difference between dog populations, by allowing a more nuanced measure of where variation is most or least likely. The method is being used increasingly in archaeology due to its simplicity (Otarola-Castillo and Torquato 2018: 436-437).

Another key field that would benefit from integration with bones are artistic depictions and iconography. Dog material culture is common: both directly related to dogs, e.g. bowls and collars, which even texts note (Smith 2005: 46), and of dogs. Artistic depictions of people and dogs, particularly small dogs, do not just begin with the Romans, but also span the Hellenistic and Late Classical worlds, and may well be influential.

Dogs have lived with humans in Europe since the Neolithic, yet we still have little idea of how relationships with them have changed over the wider era. The ancient world was the first period in which dogs were depicted in writing and mass-produced art, and has made an ideal starting point. But more time periods need study, particularly those that followed antiquity. On a practical level, comparing pathology and dog numbers between time periods will be essential for determining the relative welfare and ubiquity of canines in each. More widely, considering the legacy of the Roman Empire on human-animal interactions is greatly needed. How much of medieval hunting culture, in particular the use of dogs, has roots from ancient scholarship? Clearly, the wider story of humans and dogs has yet to be concluded.

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Appendices

Appendix D: Database of Secondary Data (digital)
https://doi.org/10.25392/leicester.data.12357392

Appendix E: Database of Recorded ABG Data (digital)
https://doi.org/10.25392/leicester.data.12357392

Appendix Explanatory Notes

Appendices A, C and E cover supplementary information about the dog ABGs, and are designed to be used together. Appendix A provides a biographical overview of each dog, Appendix C provides images of key lesions (around 40 in total) and Appendix E contains the full recorded data. The latter comprises basic contextual data, a full bone and dental inventory, metric data and butchery and pathology data (see 3.2 for further details). As a major component of the thesis, each dog ABG and each pathological lesion has been assigned a unique ID number.

All three appendices sort dog data according to their ID, e.g. OW-1 stands for Owslebury dog 1 (see 3.2.8). Data in Appendices A and C are arranged alphabetically by ABG ID, and both use Appendix E's lesion IDs to cross-reference key lesions. If, for instance, a lesion of interest is noted in Appendix A, Appendix C may contain an image of the lesion and Appendix E will contain the raw data pertaining to it. Descriptive notes are included in Appendix E as part of the recording system.

Appendices B and D comprise the secondary analysis data. The former contains the statistical analysis results alongside a small number of non-essential analysis charts, and the latter comprises the raw dataset for reference.

Appendix A: ABG Biographies

Reference Notes/Key

<u>Age at Death:</u> uses fusion and tooth wear data to determine.

<u>Shape:</u> uses Slenderness Index (SI) to determine approximate build of the dog.

ID BAL 252-1

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Baldock
Phase: 1st-2nd AD
Region: East
Site Type: Urban

Pathology: Present
No Lesions: 2

(ID) Key Lesions/Anomalies:

1	Mandible	Bone Formation	Arthropathy	Enthesophyte
3	Mandible	Bone Formation	Arthropathy	Enthesophyte

1 **Key Dental:** P2 Calculus, Alveolar Recession

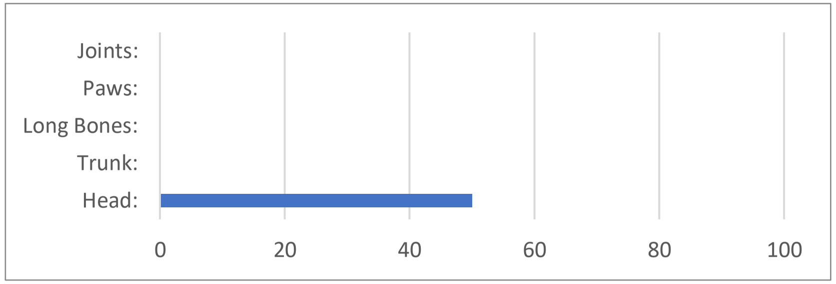
Age at Death: Older Adult

After Death:

Context Type: Unknown
Butchery: Absent
Preservation: Good
Gnawing: Absent

No. Bones (Ex. Ribs): 2
No Teeth: 7

Completeness:



Summary:

Little is known about this dog's life, except that it lived sometime during the 1st-2nd century AD. It had enthesophytes around both mandibles, which were likely age-related. Slight peridontal disease was apparent around the second premolar.

Summary:

The dog died in later adulthood, but little of it survived after death. Only part of the head was recovered, and a number of teeth. No signs of butchery or gnawing were present.

ID BAL 252-2

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Baldock
Phase: 1st-2nd AD

Region: East
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Summary:

Another dog for which little is known, except when it lived. No lesions were present.

Age at Death: Adult

After Death:

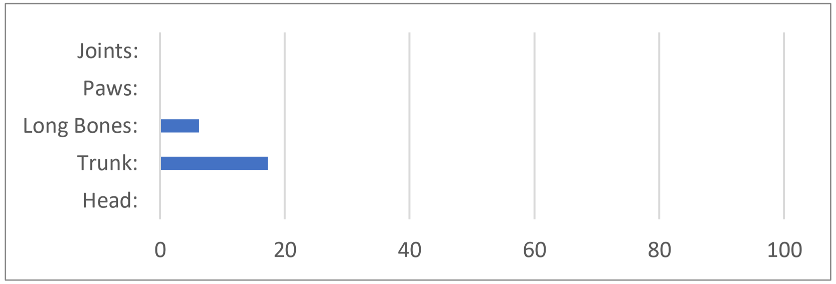
Context Type: Unknown
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 8

No Teeth: 0

Completeness:



Summary:

The dog died at an unknown point in adulthood. Due to report issues, the context from which is was recovered is unknown. The few bones that survived were in good condition, free of butchery or gnawing.

ID BAL 252-3

During Life:

Sex: Unknown
Withers (cm): 27.6
Shape: Robust

Location: Baldock
Phase: 1st-2nd AD
Region: East
Site Type: Urban

Pathology: Present
No Lesions: 13

(ID) Key Lesions/Anomalies:

ID				
9	Femur	Shape Alteration	Congenital	Bowing
10	Tibia	Shape Alteration	Congenital	Bowing
12	Humerus	Shape Alteration	Congenital	Bowing
14	Radius	Shape Alteration	Congenital	Bowing
16	Radius	Shape Alteration	Congenital	Metaphyseal Expansion
19	Ulna	Shape Alteration	Congenital	Bowing

Key Dental:

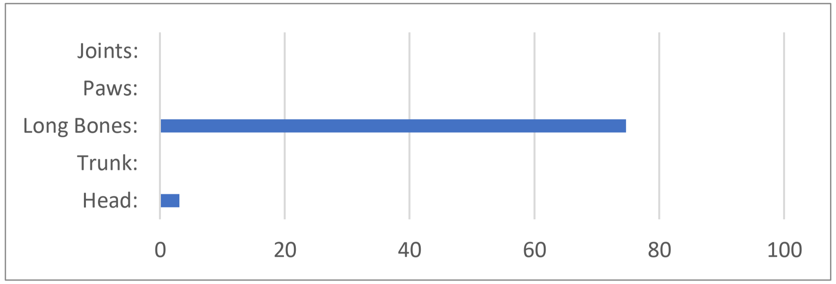
Age at Death: Adult

After Death:

Context Type: Unknown
Butchery: Absent
Preservation: Good
Gnawing: Absent

No. Bones (Ex. Ribs): 9
No Teeth: 4

Completeness:



Summary:

A small but robust dog, BAL 252-3 lived sometime during the 1st-2nd century AD. All long bones found were short and twisted, characteristic of a dog with chondrodystrophy.

Summary:

Most of the surviving bones were long bones, which were found in a good condition. The dog died when it was an adult, and the recovered bones were not gnawed or butchered before deposition.

ID BAL 438

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Baldock
Phase: 1st-2nd AD

Region: East
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Summary:

Almost nothing was known about this dog's life, aside from the fact it lived sometime in the 1st-2nd century AD.

Age at Death: Immature

After Death:

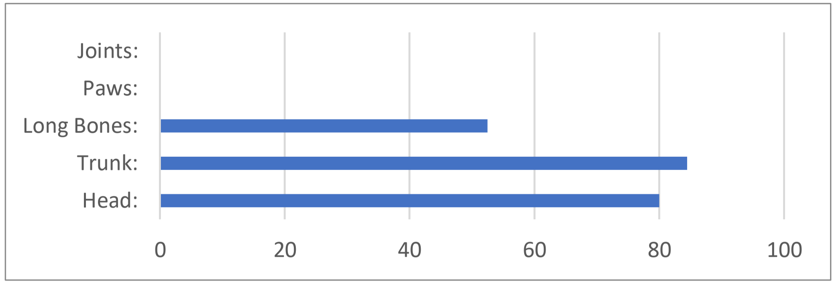
Context Type: Unknown
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 41

No Teeth: 13

Completeness:



Summary:

The dog died very young, before most bones had fused and adult teeth had erupted (aside from the first molar). Most bones, aside from paws and joints, survived in average condition.

ID BAL 485-1

During Life:

Sex:	Unknown	**Withers (cm):**	25.8
		Shape:	Medium
Location:	Baldock	**Region:**	East
Phase:	1st-2nd AD	**Site Type:**	Urban
Pathology:	Present	**No Lesions:**	6

(ID) Key Lesions/Anomalies:

21	Femur	Shape Alteration	Congenital	Bowing
23	Femur	Shape Alteration	Congenital	Bowing
24	Humerus	Shape Alteration	Congenital	Bowing
25	Humerus	Shape Alteration	Congenital	Bowing
26	Scapula	Bone Destruction	Congenital	Porosity
27	Femur	Bone Formation	Trauma	Enthesophyte
4	**Key Dental:**	M1	Attrition, Recession	
5		M1	Unusual Tooth Wear	

Summary:

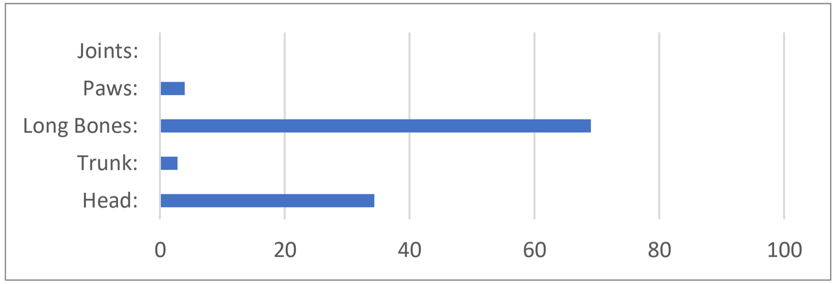
A very small dog of medium build, the smallest in the entire dataset. Suffered from chondrodystrophy, and may have developed an enthesophyte from a minor strain or injury. Early stages of peridontal disease were present.

Age at Death: Young Adult

After Death:

Context Type:	Unknown	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	13	**No Teeth:**	4

Completeness:



Summary:

Died when a young adult, mainly the long bones and head survive. These were found in good condition, with no butchery or gnawing. Deposition context is unknown.

ID BAL 485-2

During Life:

Sex: Unknown
Withers (cm): 32.2
Shape: Unknown

Location: Baldock
Region: East
Phase: 1st-2nd AD
Site Type: Urban

Pathology: Present
No Lesions: 4

(ID) Key Lesions/Anomalies:

51	Tibia	Bone Formation	Arthropathy	Extension of Bone Ridge
52	Thoracic Vert	Bone Formation	Trauma	Callus
53	Thoracic Vert	Bone Formation	Trauma	Callus
54	Rib	Shape Alteration	Trauma	Bowing

Key Dental:

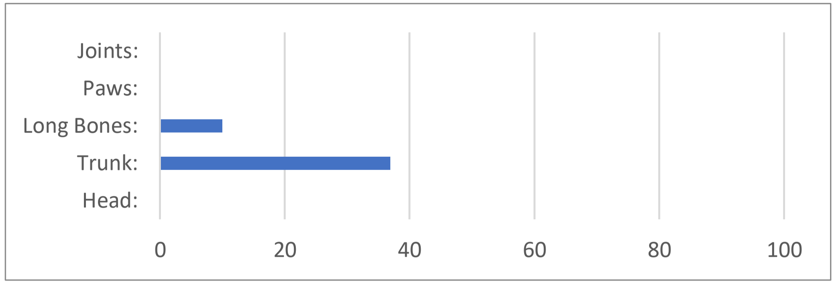
Age at Death: Adult

After Death:

Context Type: Unknown
Butchery: Absent
Preservation: Average
Gnawing: Present

No. Bones (Ex. Ribs): 12
No Teeth: 0

Completeness:



Summary:

A small dog that lived between the 1st-2nd century AD. Several lesions were present, indicating trauma to the trunk. Another lesion was indicative of advancing age.

Summary:

Died sometime in adulthood, the body had been gnawed by scavengers before final burial. Only a small number of long bones and trunk bones present, in average condition. Context type was unknown, but dog was deposited with BAL 485-3 and 485-4.

ID BAL 485-3

During Life:

Sex: Unknown
Withers (cm): 40.6
Shape: Slender

Location: Baldock
Phase: 1st-2nd AD
Region: East
Site Type: Urban

Pathology: Present
No Lesions: 2

(ID) Key Lesions/Anomalies:

55	Axis	Fracture	Trauma		0
56	Axis	Shape Alteration	Congenital	Other	

Key Dental:

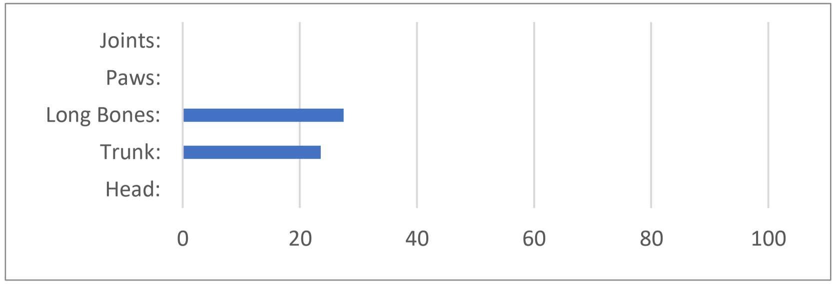
Age at Death: Adult

After Death:

Context Type: Unknown
Butchery: Absent
Preservation: Excellent
Gnawing: Absent

No. Bones (Ex. Ribs): 9
No Teeth: 0

Completeness:



Summary:

A dog of average height but slender build that lived during the 1st and 2nd century AD. Suffered a fracture to the axis that was healing at the time of death. The same axis had slight assymmetry, which may have been a congenital anomaly.

Summary:

The dog had reached adulthood by the time it died, but its age is otherwise unknown. Although the context is unknown, most bones were lost but those that recovered were in excellent condition. Found with BAL 485-3.

ID BAL 485-4

During Life:

Sex: Unknown

Withers (cm): 45.1
Shape: Medium

Location: Baldock
Phase: 1st-2nd AD

Region: East
Site Type: Urban

Pathology: Present

No Lesions: 6

(ID) Key Lesions/Anomalies:

(ID)	Bone	Type	Category	Lesion
57	Tibia	Bone Formation	Arthropathy	Enthesophyte
58	Ulna	Bone Formation	Arthropathy	Enthesophyte
59	Ulna	Bone Destruction	Arthropathy	Articular Groove
60	Ulna	Bone Destruction	Arthropathy	Eburnation
61	Ulna	Bone Formation	Arthropathy	Osteophyte
62	Femur	Bone Formation	Arthropathy	Extension of Bone Ridge

Key Dental:

Age at Death: Adult

After Death:

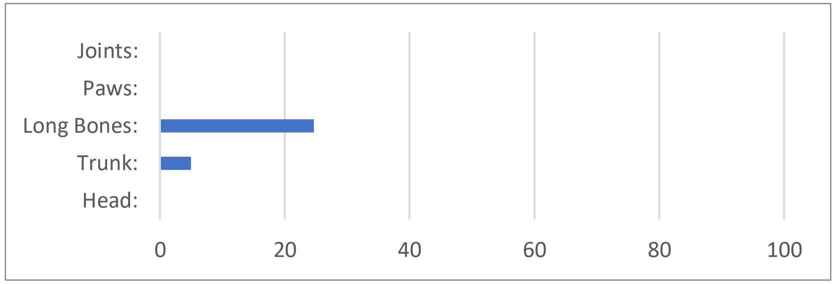
Context Type: Unknown
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 4

No Teeth: 0

Completeness:



Summary:

A dog of medium size and build that lived sometime between the 1st-2nd century AD. Had many lesions on the , but all were age-related

Summary:

Found in an unknown context with BAL 485-2 and 485-3. May have been buried at same time, although gnawing has affected the former suggesting it may have been deposited in another instance. Few bones survive, mainly long bones.

ID BAL 506

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Baldock
Phase: 1st-2nd AD
Region: East
Site Type: Urban

Pathology: Absent
No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

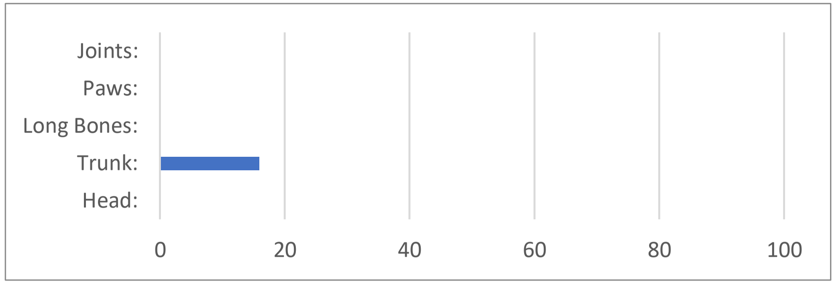
Age at Death: Adult

After Death:

Context Type: Unknown
Preservation: Average
Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 3
No Teeth: 0

Completeness:



Summary:

Very little is known about the dog's life, except that it lived in Baldock in the 1st-2nd century AD.

Summary:

Few bones, in average condition, survive from the dog. It died when it was an adult, but the context it was recovered from is uknown.

ID BAL 524

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Baldock
Phase: 1st-2nd AD
Region: East
Site Type: Urban

Pathology: Present
No Lesions: 1

(ID) Key Lesions/Anomalies:

6	Mandible	Bone Formation	Trauma	Enthesophyte

2 **Key Dental:** M1, M2 Tooth Crowding

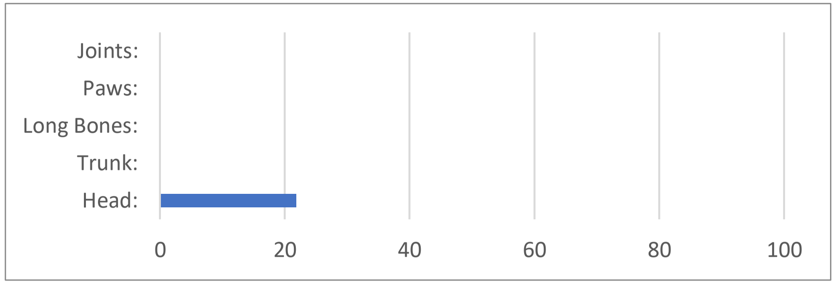
Age at Death: Unknown

After Death:

Context Type: Unknown
Butchery: Absent
Preservation: Good
Gnawing: Absent

No. Bones (Ex. Ribs): 1
No Teeth: 3

Completeness:



Summary:

Very little is known about the dog, except that it lived sometime during the 1st-2nd century AD. There is a lesion on the mandible that may be caused by trauma, and the M1 and M2 were crowded together in the mandible.

Summary:

Died at an unknown age, but old enough to have adult dentition with very slight wear. While well preserved, very little of the ABG survived.

ID BAL 524-2

During Life:

Sex:	Unknown	**Withers (cm):**	Unknown
		Shape:	Unknown
Location:	Baldock	**Region:**	East
Phase:	1st-2nd AD	**Site Type:**	Urban
Pathology:	Present	**No Lesions:**	2

(ID) Key Lesions/Anomalies:

228	Metatarsal	Bone Formation	Arthropathy	Enthesophyte
229	Thoracic Vert	Bone Formation	Arthropathy	Osteophyte

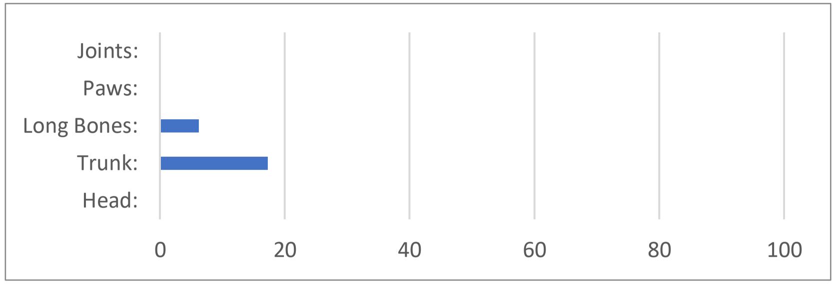
Key Dental:

Age at Death: Adult

After Death:

Context Type:	Unknown	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	21	**No Teeth:**	0

Completeness:



Summary:

Little was known about this dog's life. It lived sometime during the 1st-2nd century AD, and suffered from a couple of age-related lesions. This suggests it may have been approaching middle adulthood or later when it died.

Summary:

Died during adulthood. The context also contained remains of other dogs and a couple of bones from other mammals, suggesting burial may have been with other animals or open deposit. A small number of bones survived from the trunk and longbones.

ID BAL-526

During Life:

Sex: Unknown

Withers (cm): 57.5
Shape: Medium

Location: Baldock
Phase: 1st-2nd AD

Region: East
Site Type: Urban

Pathology: Present

No Lesions: 16

(ID) Key Lesions/Anomalies:

(ID)	Element	Lesion	Category	Description
232	Humerus	Bone Formation	Arthropathy	Enthesophyte
233	Femur	Bone Destruction	Arthropathy	Porosity
234	Tibia	Bone Formation	Trauma	Periostosis
240	Ulna	Bone Formation	Arthropathy	Extension of Bone Ridge
242	Metatarsal	Shape Alteration	Congenital	Bowing
246	Humerus	Bone Destruction	Arthropathy	Articular Groove
58	**Key Dental:**	P1, P4, I1, I2	Ante-Mortem Tooth Loss, Various Stages	
63		P1	Possible Supernumary Tooth	

Age at Death: Adult

After Death:

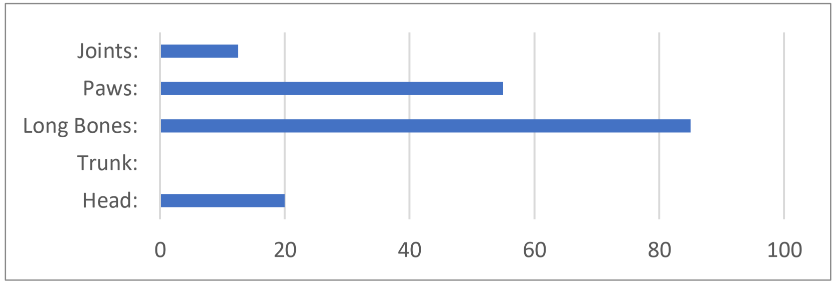
Context Type: Unknown
Preservation: Excellent

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 33

No Teeth: 8

Completeness:



Summary:

One of the largest dogs in the dataset and of medium build. Affected by a substantial number of lesions, many age-related, but also suffered from a leg injury at some point in life. Many teeth were lost before death and was born with an extra tooth.

Summary:

Died at an unknown point in adulthood. The bones were very well preserved, and a reasonable number survived except for the trunk. No instances of butchery or gnawing were found.

ID BC-1

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Balksbury Camp
Phase: MIA/LIA
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 0

(ID) Key Lesions/Anomalies:

46 **Key Dental:** Mandible — Alveolar Recession

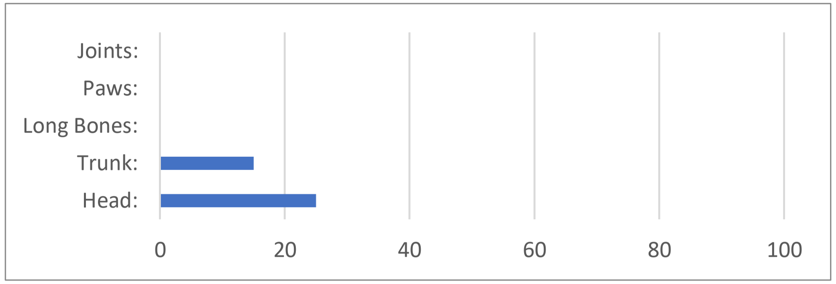
Age at Death: Older Adult

After Death:

Context Type: Pit
Preservation: Average
Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 4
No Teeth: 6

Completeness:



Summary:

Little is known about this dog's life, except that it lived during the Middle or Late Iron Age. The only pathology present is some alveolar recession around the gum line of the mandible.

Summary:

Died as an older adult, although few bones survive. What was present, a few vertebrae and a mandible with most of its teeth, was found in a pit in reasonable condition. No butchery or gnawing occured after death.

ID BC-2

During Life:

Sex: Unknown
Withers (cm): 49.4
Shape: Robust

Location: Balksbury Camp
Phase: LIA
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 3

(ID) Key Lesions/Anomalies:

(ID)	Element	Type	Category	Lesion
201	Metacarpal	Bone Formation	Arthropathy	Enthesophyte
202	Tibia	Bone Formation	Arthropathy	Osteophyte
203	Cervical Verte	Bone Formation	Arthropathy	Extension of Bone Ridge

Key Dental:

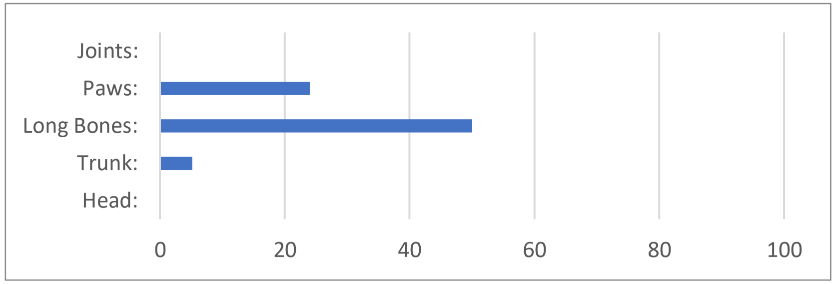
Age at Death: Adult

After Death:

Context Type: Pit
Butchery: Absent
Preservation: Average
Gnawing: Absent

No. Bones (Ex. Ribs): 14
No Teeth: 0

Completeness:



Summary:

A reasonably large dog of robust build, it lived during the Late Iron Age. The lesions present were subtle and focused mainly on articular surfaces, suggesting they may have been linked with older age.

Summary:

An adult of unknown specific age at death, although likely older, the dog was deposited in a pit. The body was not gnawed by scavengers or butchered, but many bones were still lost. Most surviving bones were long bones or paw bones.

ID BC-3

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Balksbury Camp
Phase: MIA/LIA

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 0

(ID) Key Lesions/Anomalies:

47 **Key Dental:** M1 Hypoplasia

Age at Death: Young Adult

After Death:

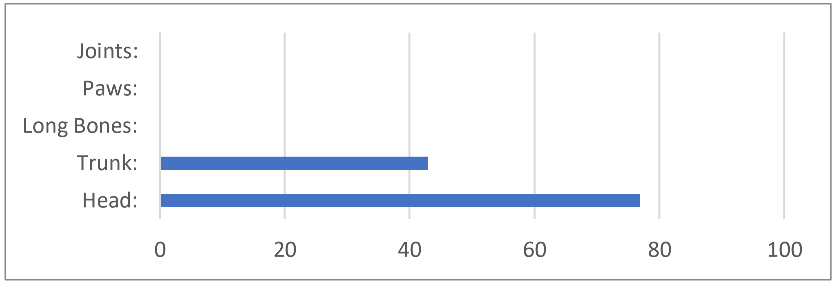
Context Type: Pit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 14

No Teeth: 29

Completeness:



Summary:

Although little is known about the dog's physiology, it has an unusual anomaly. The mandibular first molar has circular patches with no enamel and exposed dentin. Likely hypoplasia, which may have been caused in utero or very early life (Chapter 7).

Summary:

After an untimely death in early adulthood, most of the dog's head and trunk survived. Like most Iron Age ABGs, the dog was deposited in a pit, where the bones that survived were better preserved than average. Most of its teeth were recovered.

ID BC-4

During Life:

Sex:	Unknown	**Withers (cm):**	48.1
		Shape:	Medium
Location:	Balksbury Camp	**Region:**	South
Phase:	MIA/LIA	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	6

(ID) Key Lesions/Anomalies:

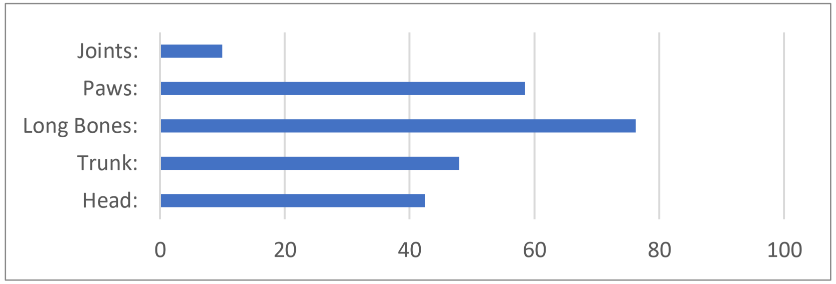
204	Lumbar Verte	Shape Alteration	Unknown	Bowing
205	Lumbar Verte	Bone Formation	Disease or tra	Periostosis
206	Thoracic Vert	Bone Formation	Disease or tra	Periostosis
207	Lumbar Verte	Bone Destruction	Disease or tra	Necrosis
208	Thoracic Vert	Bone Destruction	Disease or tra	Necrosis
209	Rib	Bone Formation	Disease or tra	Periostosis
48	**Key Dental:**	Maxilla	Alveolar Recession	
49		Mandible	Alveolar Recession	

Age at Death: Older Adult

After Death:

Context Type:	Pit	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Present
No. Bones (Ex. Ribs):	53	**No Teeth:**	14

Completeness:



Summary:

A fairly large dog of medium build, it lived during either the Middle or Late Iron Age. Its life was mostly defined by a severe back injury. It is difficult to tell if this was caused by an accident, infectious disease or both.

Summary:

The dog generally survived very well, both in terms of bone preservation and the number of bones that were found. It was likely an older adult when it died, perhaps in relation to its injury.

ID BC-5

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Balksbury Camp
Phase: MIA/LIA

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 2

(ID)	Key Lesions/Anomalies:			
210	Lumbar Verte	Shape Alteration	Unknown	Bowing
211	Lumbar Verte	Shape Alteration	Unknown	Bowing

Key Dental:

Summary:

Little was known about the dog itself, except that it had bowed spinous processes and lived in either the Middle or Late Iron Age. The lesions are found on many dogs, but their ultimate cause is not known.

Age at Death: Adult

After Death:

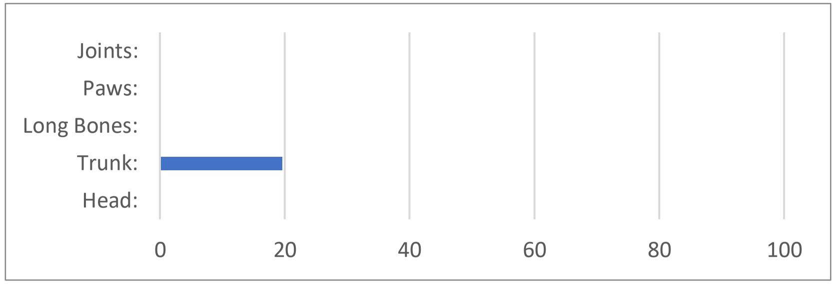
Context Type: Pit
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 5

No Teeth: 0

Completeness:



Summary:

Only the trunk survived, with a substantial number ribs broken after death. When the dog died is unknown, except that it was an adult. Reasonably well preserved, it was deposited in a pit. There are no signs of butchery or disturbance by scavengers.

ID BC-6

During Life:

Sex:	Unknown	**Withers (cm):**	47.5
		Shape:	Medium
Location:	Balksbury Camp	**Region:**	South
Phase:	MIA	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	9

(ID) Key Lesions/Anomalies:

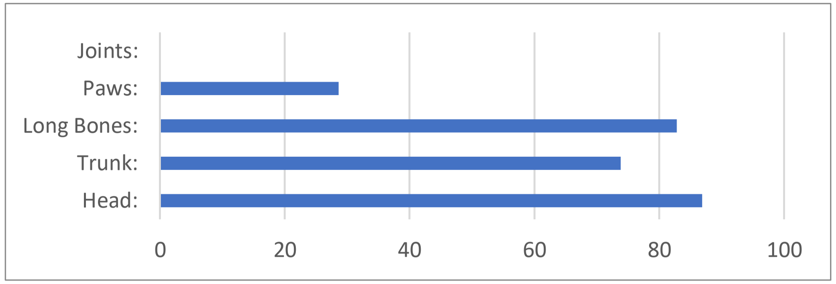
212	Sacrum	Shape Alteration	Unknown	Bowing
213	Lumbar Verte	Shape Alteration	Unknown	Bowing
215	Thoracic Vert	Shape Alteration	Unknown	Bowing
216	Rib	Bone Formation	Trauma	Periostosis
219	Metacarpal	Bone Formation	Trauma	Periostosis
220	Scapula	Bone Formation	Arthropathy	Extension of Bone Ridge
50	**Key Dental:**	M1	Cavity	
51		M1	Cavity	

Age at Death: Older Adult

After Death:

Context Type:	Pit	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	50	**No Teeth:**	16

Completeness:



Summary:

As with most of the other Balksbury dogs, it was reasonably large, of a medium build. It lived in the Middle Iron Age, where it may have suffered a few minor injuries to the rib and paw. Very slight cavities in the molars were also present.

Summary:

Although the joint bones are entirely missing, the dog otherwise survived very well. Deposited in a pit and not disturbed, the skeleton suggests the dog died sometime in later adulthood.

ID CA-1

During Life:

Sex: Unknown

Withers (cm): 26.6
Shape: Slender

Location: Caistor
Phase: Mid-late 2nd AD

Region: East
Site Type: Urban

Pathology: Present

No Lesions: 0

(ID) Key Lesions/Anomalies:

24	**Key Dental:**	P3, P4	Tooth Rotation
26		P2, M3	Congenitally Absent

Age at Death: Young Adult

After Death:

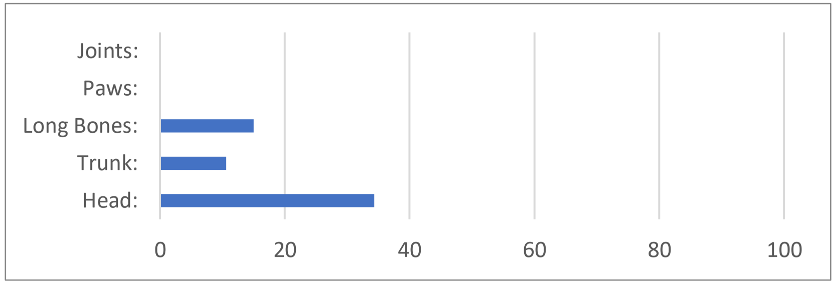
Context Type: Ditch
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 7

No Teeth: 10

Completeness:



Summary:

The smallest dog of the group, it is both very small and slender in build. This tiny size is reflected in its dental issues, which include a congenitally absent molar, and possibly premolar. Several remaining teeth were rotated in the jaw due to lack of space.

Summary:

Died sometime in early adulthood, the body was deposited in a ditch, very close to a deposit with a human skeleton (Bowden pers. comm). The bones that survive are in good condition, but a substantial number were lost - particularly small bones.

ID CA-2

During Life:

Sex: Unknown

Withers (cm): 30.6
Shape: Robust

Location: Caistor
Phase: Mid 3rd-4th AD

Region: East
Site Type: Urban

Pathology: Present

No Lesions: 4

(ID) Key Lesions/Anomalies:

71	Pelvis	Fracture	Trauma	Incomplete
72	Femur	Size Alteration	Disease	Enlarged
73	Tibia	Shape Alteration	Congenital	Bowing
74	Tibia	Size Alteration	Disease	Enlarged

Key Dental:

Age at Death: Adult

After Death:

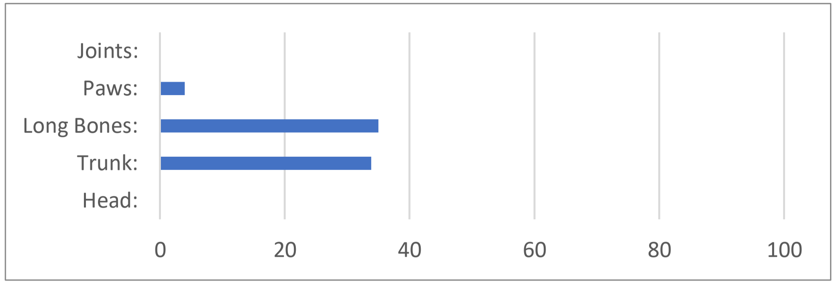
Context Type: Deposit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 24

No Teeth: 0

Completeness:



Summary:

A short, robust dog with twisted limbs, likely congenital dwarfism. Interesting series of lesions (Chapter 7), such as small fracture in the pelvis. This healed but may be linked to possible rickets of leg bones. Exceptionally good diet (see isotope results, Appendix E).

Summary:

Died at an unknown stage in adulthood, and placed in a deposit. Survived fairly well, although many bones in the head and paws are missing.

ID DA-1

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Danebury
Phase: 0

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Unknown

After Death:

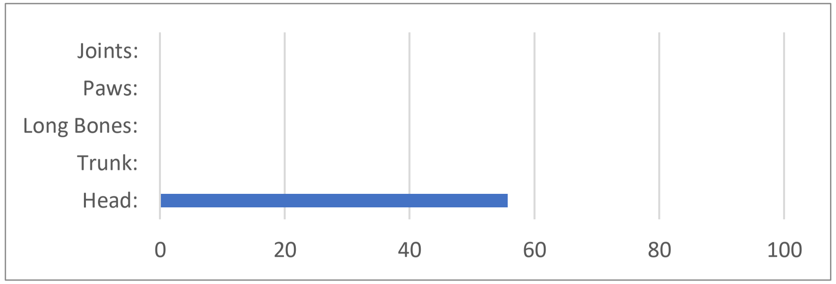
Context Type: Pit
Preservation: Poor

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 2

No Teeth: 10

Completeness:



Summary:

Very little known about the dog, except that it lived in the Iron Age. No lesions or anomalies were identified.

Summary:

Age of death cannot be confirmed, but likely during adulthood. Only the head survives, including the skull and a slightly burnt mandible. Unknown if this was deposited in the pit separately to the body, especially given the poor preservation of the bones.

ID DA-2

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Danebury
Phase: MIA
Region: South
Site Type: Rural

Pathology: Absent
No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

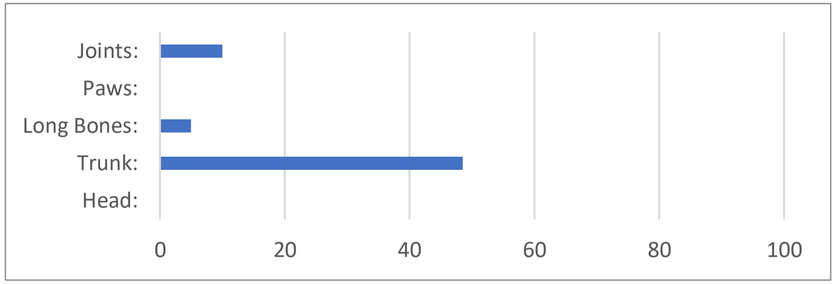
Age at Death: Subadult

After Death:

Context Type: Pit
Preservation: Average
Butchery: Absent
Gnawing: Present

No. Bones (Ex. Ribs): 22
No Teeth: 1

Completeness:



Summary:

Lived during the Middle Iron Age, but no other hints about the dog's life are present. No pathology or abnormalities are present.

Summary:

Dog died just before reachng maturity. The body was gnawed heavily by scavengers, suggesting it was not buried immediately after deposition in the pit. Modest survival of bones, mainly from the trunk.

ID DA-3

During Life:

Sex: Unknown
Withers (cm): 42.5
Shape: Medium

Location: Danebury
Phase: 0
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 2

(ID) Key Lesions/Anomalies:

63	Thoracic Vert Shape Alteration	Unknown	Bowing
64	Thoracic Vert Bone Formation	Trauma	Periostosis

15	**Key Dental:** P3		Ante-Mortem Tooth Loss
16	P2		Ante-Mortem Tooth Loss, Healed

Summary:

Lived during the Iron Age, the dog was of medium size and build. Signs of trauma were present on the vertebrae and possibly through two premolars lost before death. The teeth were at different healing stages, and were lost at different times.

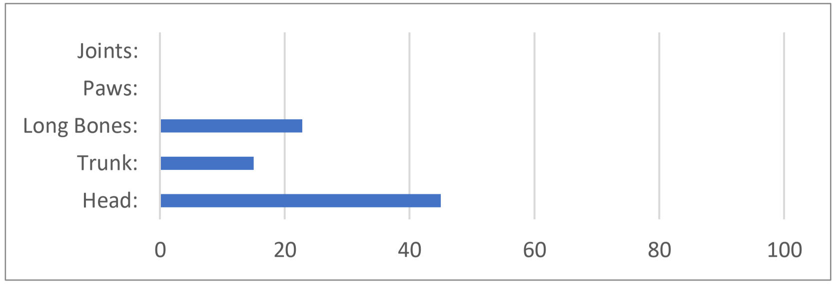
Age at Death: Older Adult

After Death:

Context Type: Pit
Butchery: Present
Preservation: Good
Gnawing: Absent

No. Bones (Ex. Ribs): 23
No Teeth: 6

Completeness:



Summary:

Like most Iron Age dogs, it was buried in a pit. Death occurred at middle age or older, and the body was butchered, likely to obtain the skin.

ID DA-4

During Life:

Sex: Male

Withers (cm): 41.9
Shape: Slender

Location: Danebury
Phase: 0

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 0

(ID) Key Lesions/Anomalies:

17 **Key Dental:** M2 Cavity

Age at Death: Young Adult

After Death:

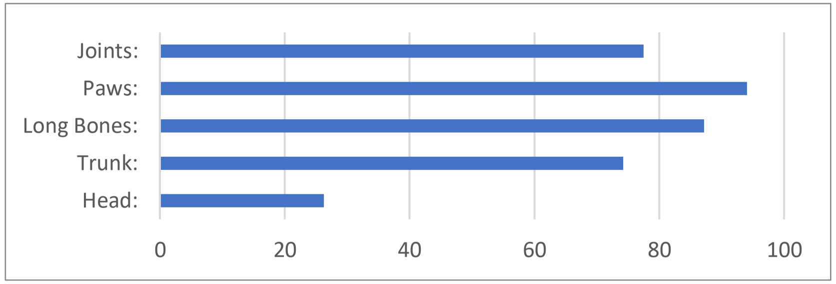
Context Type: Pit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 132

No Teeth: 37

Completeness:



Summary:

One of the few dogs reliably identified as male, it lived during the Iron Age. Slender of build, it was of medium height at withers. The second molar had slight pitting and discoloration, likely mild caries or a precursor.

Summary:

Died just after reaching physical maturity, the dog was deposited in a pit. Here, the body survived extremely well aside from the skull which was heavily fragmented.

ID DA-5

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Danebury
Phase: 0

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Immature

After Death:

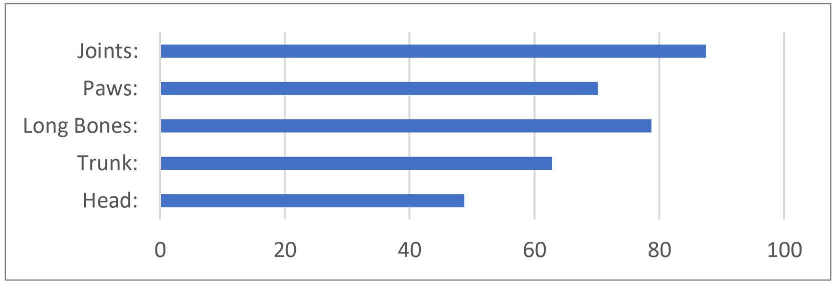
Context Type: Pit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 87

No Teeth: 19

Completeness:



Summary:

The life of the dog is largely a mystery, aside from the fact it lived in the Iron Age. No signs of pathology or abnormalities may be seen.

Summary:

Died when very young, most of the bones were unfused. The skeleton was recovered in good condition from a pit, and most of the bones survived. The skull was recovered, but somewhat fragmented.

ID DA-6

During Life:

Sex: Unknown

Withers (cm): 30.6
Shape: Robust

Location: Danebury
Phase: LIA

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 4

(ID) Key Lesions/Anomalies:

(ID)	Element	Lesion	Category	Type
65	Lumbar Verte	Bone Formation	Arthropathy	Osteophyte
66	Pelvis	Bone Formation	Arthropathy	Enthesophyte
67	Tibia	Shape Alteration	Congenital	Bowing
68	Tibia	Shape Alteration	Congenital	Bowing

Key Dental:

Age at Death: Adult

After Death:

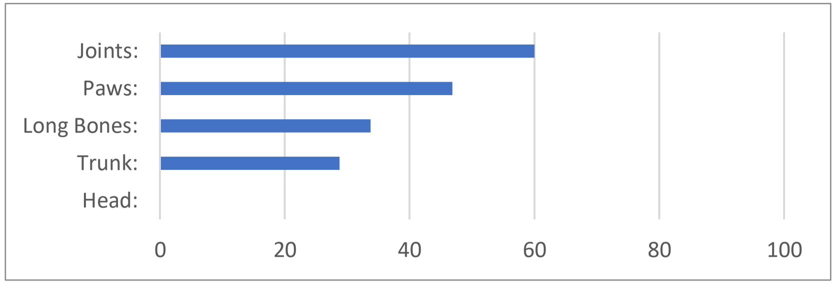
Context Type: Pit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 72

No Teeth: 0

Completeness:



Summary:

An unusual dog for the Iron Age, it was very short and with robust, twisted limbs. The fact it was found in the later part of the period may be significant (see Chapter 7). Two small lesions suggest it may have been an older animal.

Summary:

Died sometime in adulthood, likely middle age of older. The head was missing, but the skeleton was otherwise recovered from the pit in good condition. No signs of butchery or gnawing were found.

ID DA-7

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Danebury
Phase: LIA
Region: South
Site Type: Rural

Pathology: Absent
No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

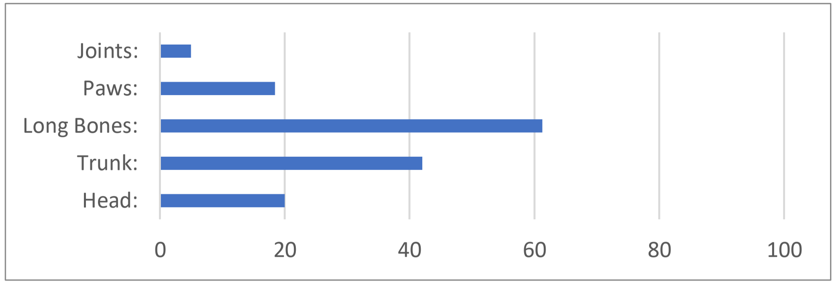
Age at Death: Immature

After Death:

Context Type: Pit
Preservation: Good
Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 33
No Teeth: 3

Completeness:



Summary:

The dog lived sometime in the later Iron Age, but otherwise very little is known about it. No pathology or abnormalities were found, although this may be linked to its age at death.

Summary:

Most of the bones were unfused, and thus the dog died when very young. As with many Iron Age dogs, the body was deposited in a pit. Here, the skeleton survived reasonably well aside from the small joint bones.

ID DA-8

During Life:

Sex: Unknown

Withers (cm): 51.8
Shape: Medium

Location: Danebury
Phase: 0

Region: South
Site Type: Rural

Pathology: Present
No Lesions: 0

(ID) Key Lesions/Anomalies:

18 **Key Dental:** Mandible — Alveolar Recession
19 Maxilla — Alveolar Recession

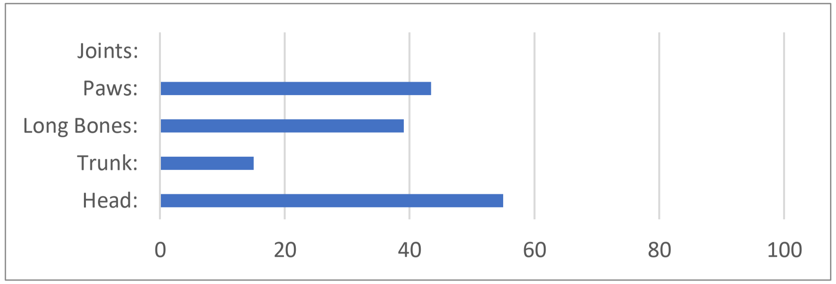
Age at Death: Young Adult

After Death:

Context Type: Pit
Butchery: Present
Preservation: Average
Gnawing: Absent

No. Bones (Ex. Ribs): 44
No Teeth: 37

Completeness:



Summary:

A tall dog of medium build, it suffered from widespread (but not severe) peridontal disease that affected the entire mouth. It lived in the Iron Age.

Summary:

Died sometime in early adulthood, the body was skinned before being deposited in a pit. The skeleton survived reasonably well, and paw bones were recovered, suggesting they had not been removed with the pelt.

ID DA-9

During Life:

Sex: Unknown
Withers (cm): 50.9
Shape: Medium

Location: Danebury
Phase: 0
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 1

(ID) Key Lesions/Anomalies:

69	Femur	Fracture	Trauma	Oblique

20 **Key Dental:** M1 Cavity

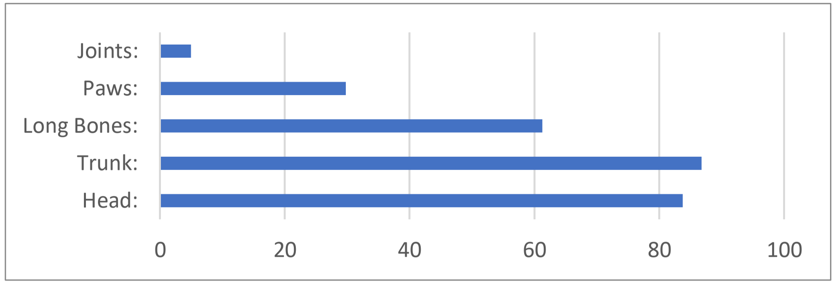
Age at Death: Older Adult

After Death:

Context Type: Pit
Butchery: Absent
Preservation: Average
Gnawing: Absent

No. Bones (Ex. Ribs): 63
No Teeth: 30

Completeness:



Summary:

A tall dog of medium build, it suffered a fracture to the back leg long before it died. The bone healerd reasonably well, but was rather swollen in appearance and did not repair at a completely straight angle.

Summary:

Died sometime in late adulthood, the skeleton survived reasonably well. Most large bones were recovered from the pit, including a slightly fragmented skull.

ID DA-10

During Life:

Sex: Unknown

Withers (cm): 48.2
Shape: Robust

Location: Danebury
Phase: 0

Region: South
Site Type: Rural

Pathology: Present
No Lesions: 1

(ID) Key Lesions/Anomalies:

70	Metacarpal	Bone Formation	Trauma	Periostosis

Key Dental:

21	C	Ante-Mortem Tooth Loss, Draining Cloaca
22	M1	Cavity

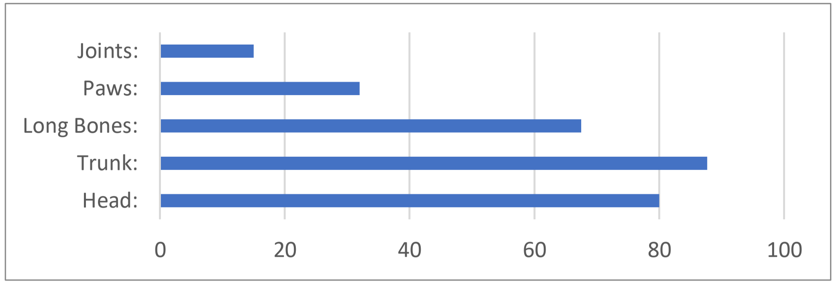
Age at Death: Young Adult

After Death:

Context Type: Pit
Butchery: Absent
Preservation: Good
Gnawing: Absent

No. Bones (Ex. Ribs): 53
No Teeth: 34

Completeness:



Summary:

A medium-to-large, yet robust dog, signs of a minor injury to the paw are present. Additionally, a canine was lost sometime before death, either from local infection or trauma. It lived during the Iron Age.

Summary:

Died fairly young, but reached adulthood. The body was then deposited in a bit, where it survived well to the present day. The major bones are mostly present, and some small bones were also recovered.

ID FB-1

During Life:

Sex:	Unknown	**Withers (cm):**	27.6
		Shape:	Robust
Location:	Fishbourne	**Region:**	South
Phase:	2nd - 3rd AD	**Site Type:**	Rural
Pathology:	Present	**Postcranial Lesions:**	9

(ID) Key Lesions/Anomalies:

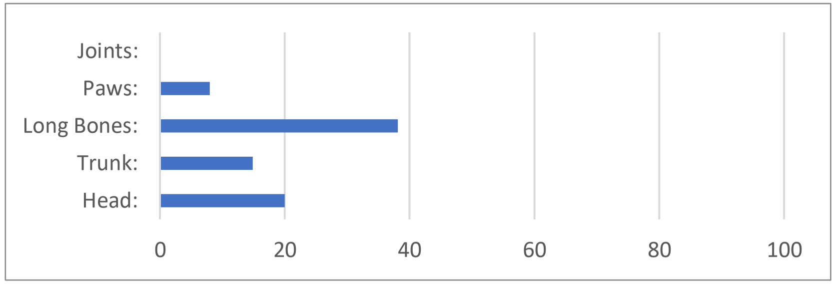
76	Humerus	Shape Alteration	Congenital	Bowing
78	Radius	Bone Formation	Disease	Periostosis
79	Ulna	Bone Formation	Disease	Periostosis
81	Humerus	Bone Formation	Disease	Enthesophyte
82	Scapula	Bone Formation	Disease	Extension of Bone Ridge
83	Humerus	Bone Destruction	Arthropathy	Eburnation
28	**Key Dental:** C		Calculus	

Age at Death: Adult

After Death:

Context Type:	Unknown	**Butchery:**	Present
Preservation:	Average	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	11	**No Teeth:**	7

Completeness:



Summary:

A very small dog but robust in built, its limbs were heavily bowed. The dog may have suffered from a systemic inflammatory disease during life, as profuse growth was found on surface of several limbs. It also had signs of osteoarthritis.

Summary:

Died at an unknown age, but likely an older adult given its age-related issues. The body was gnawed by scavengers before final burial, and many bones were ultimately lost.

ID GY-1

During Life:

Sex: Unknown | **Withers (cm):** Unknown
Shape: Unknown

Location: Greyhound Yard | **Region:** South
Phase: Latest RB | **Site Type:** Urban

Pathology: Present | **No Lesions:** 1

(ID) Key Lesions/Anomalies:

29	Thoracic Vert Bone Formation	Trauma	Osteophyte

Key Dental:

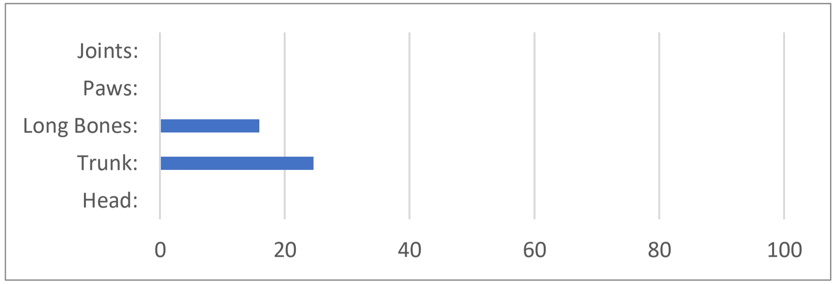
Age at Death: Subadult

After Death:

Context Type: Building | **Butchery:** Absent
Preservation: Poor | **Gnawing:** Absent

No. Bones (Ex. Ribs): 6 | **No Teeth:** 0

Completeness:



Summary:

Living near the end of the Roman occupation, clues about the dog's life are lacking. The only indicator is a small lesion that may have been caused by slight physical trauma.

Summary:

Very close to adulthood at death, nearly all the long bones were fused. Otherwise, only a small number of bones survive in rather poor condition. The dog was deposited somewhere under a building, but further details are unknown.

ID GY-2

During Life:

Sex: Unknown

Withers (cm): 48.8
Shape: Medium

Location: Greyhound Yard
Phase: Latest RB

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Adult

After Death:

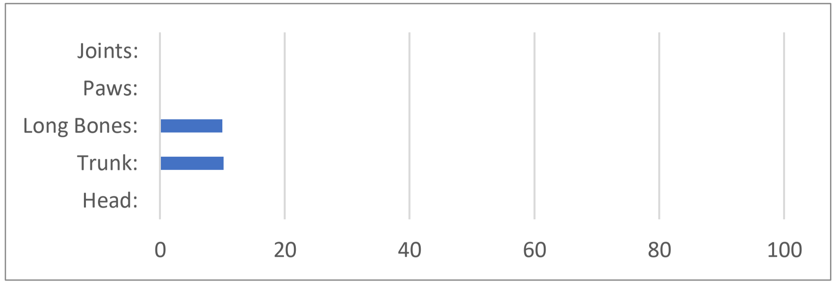
Context Type: Building
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 4

No Teeth: 0

Completeness:



Summary:

A fairly large dog of medium build, it lived near the end of the Roman period. No lesions were foud.

Summary:

Deposited somewhere under a building, further details are unknown. May have been found close to GY-1 and GY-3. The dog was an adult of unknown age when it died, and only a few long bones and vertebrae were found of it.

ID GY-3

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: Latest RB

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Adult

After Death:

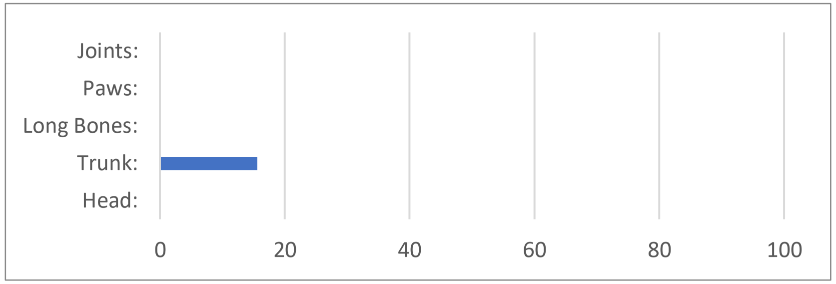
Context Type: Building
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 2

No Teeth: 0

Completeness:



Summary:

A mysterious dog, the only thing known is that it lived in the latest Roman period, at the same time as GY-1 and GY-2. No lesions or anomalies were found on its skeleton, except a slighly unusual shape variation at the proximal end of the scapula.

Summary:

Died as an adult, but at an otherwise unknown age, it was buried under a building. May have been deposited near or with GY-1 and GY-3. Only a few parts of the trunk were recovered, albeit in good condition.

ID GY-4

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Region: South
Phase: 250-400 AD
Site Type: Urban

Pathology: Present
No Lesions: 3

(ID) Key Lesions/Anomalies:

(ID)	Element	Lesion	Category	Type
84	Pelvis	Bone Formation	Arthropathy	Enthesophyte
85	Cervical Verte	Bone Formation	Arthropathy	Osteophyte
86	Thoracic Vert	Bone Formation	Arthropathy	Osteophyte

Key Dental:

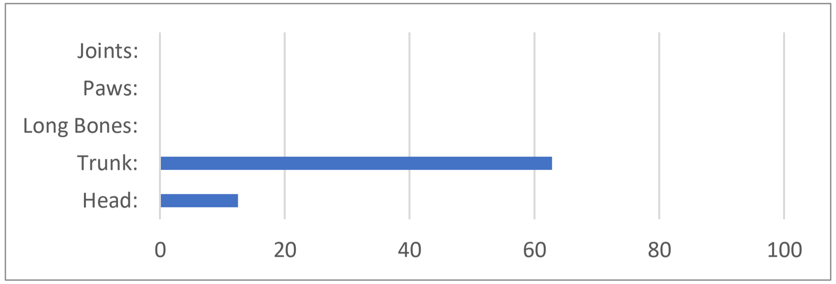
Age at Death: Older Adult

After Death:

Context Type: Pit
Butchery: Absent
Preservation: Average
Gnawing: Absent

No. Bones (Ex. Ribs): 27
No Teeth: 5

Completeness:



Summary:

Several small lesions, mainly around articular surfaces, suggest the dog lived to a fairly old age. Otherwise, it was of an unknown size and lived between the mid 3rd and the end of the 4th century AD.

Summary:

Heavily worn teeth also indicate the dog died when it was old. It was deposited in a pit, and neither butchered or gnawed. Most of the bones that survive are from the trunk, although part of a mandible was recovered.

ID GY-5

During Life:

Sex: Unknown

Withers (cm): 53.9
Shape: Medium

Location: Greyhound Yard
Phase: 75-120 AD

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) **Key Lesions/Anomalies:**

Key Dental:

Age at Death: Adult

After Death:

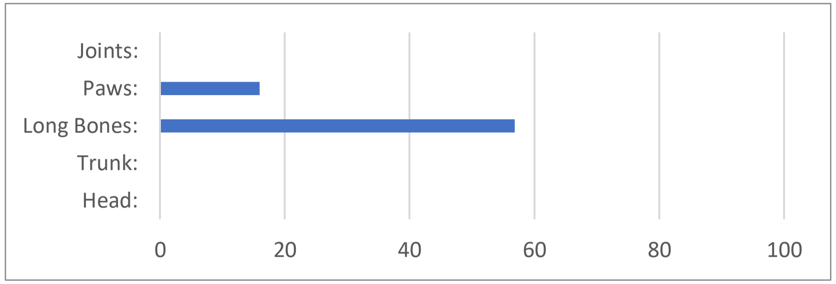
Context Type: Cess Pit
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 11

No Teeth: 0

Completeness:



Summary:

A large dog of neither robust nor thin build, it lived in the Early Roman period. No lesions were present, suggesting either young age or good health.

Summary:

Buried in a cess pit at an unknown age in adulthood, the exact use of the pit is not known. Not many bones survive, and of those that do, they are mainly long bones.

ID GY-6

During Life:

Sex:	Unknown	**Withers (cm):**	Unknown
		Shape:	Unknown
Location:	Greyhound Yard	**Region:**	South
Phase:	350-450 AD	**Site Type:**	Urban
Pathology:	Present	**No Lesions:**	1

(ID) Key Lesions/Anomalies:

87	Scapula	Bone Formation	Arthropathy	Enthesophyte

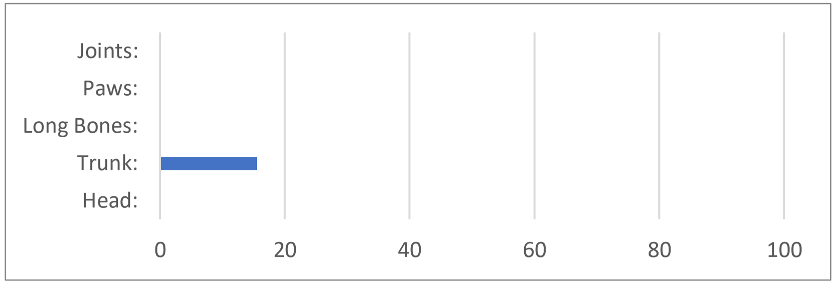
Key Dental:

Age at Death: Adult

After Death:

Context Type:	Cess Pit	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	1	**No Teeth:**	0

Completeness:



Summary:

Dating to the latest part of the Roman occupation, or perhaps even slightly afterward, little is known about this dog. The only indicator is a small nodule of bone growth on the scapula, likely caused by advanced age.

Summary:

The dog died sometime in adulthood, and then deposited in a cess pit. Few bones survive, and nearly all of these were ribs. However, no signs of butchery or scavenger gnawing may be seen.

ID GY-7

During Life:

Sex:	Male	**Withers (cm):**	31.3
		Shape:	Robust
Location:	Greyhound Yard	**Region:**	South
Phase:	350-450 AD	**Site Type:**	Urban
Pathology:	Present	**No Lesions:**	10

(ID) Key Lesions/Anomalies:

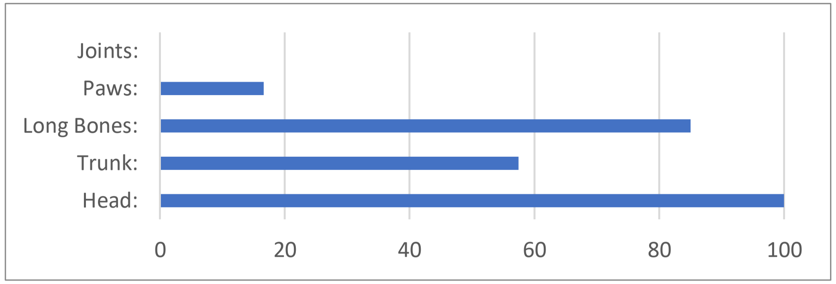
(ID)				
88	Rib	Bone Formation	Arthropathy	Periostosis
90	Thoracic Vert	Bone Formation	Trauma	Periostosis
94	Radius	Shape Alteration	Congenital	Bowing
95	Ulna	Bone Destruction	Arthropathy	Cavity
96	Pelvis	Bone Formation	Arthropathy	Osteophyte
231	Cranium	Fracture	Trauma	Impacted
29	**Key Dental:**	M1	Cavity	
30		M1	Cavity	

Age at Death: Older Adult

After Death:

Context Type:	Cess Pit	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	32	**No Teeth:**	29

Completeness:



Summary:

A male dog, indicated by the baculum, of short robust build. The limbs are bowed, indicating congenital dwarfism. A number of lesions present, some indicative of age and others of trauma. The most striking is a fracture across the nose that had begun to heal.

Summary:

Died as an older adult, then buried in a cess pit. The bones were preserved very well, and not butchered or scavenged. The skull in particular survived superbly well, and was whole.

ID GY-8

During Life:

Sex: Unknown

Withers (cm): 53.6
Shape: Medium

Location: Greyhound Yard
Phase: 75-120 AD

Region: South
Site Type: Urban

Pathology: Present

No Lesions: 2

(ID) Key Lesions/Anomalies:

97	Mandible	Bone Formation	Disease	Periostosis
98	Humerus	Bone Formation	Arthropathy	Osteophyte

31	**Key Dental:**	P4	Congenitally Absent
32		C	Attrition

Age at Death: Older Adult

After Death:

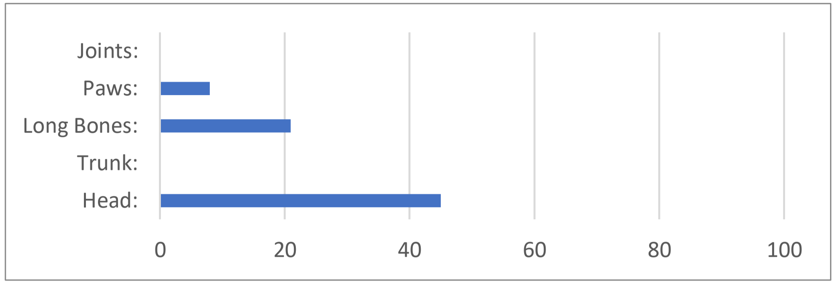
Context Type: Pit
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 8

No Teeth: 9

Completeness:



Summary:

A dog that lived in the earlier period of Roman Durnovaria, of fairly large but of average build. Unusually, the fourth premolar was absent, with no sign that this was due to tooth loss. May have suffered from local infection/inflammation in the jaw.

Summary:

When the dog died, in later adulthood, it was deposited in a pit. Unfortunately, most bones did not survive. A substantial part of the head, and a couple of longbone and paw bones, are all that remain.

ID GY-9

During Life:

Sex: Unknown
Withers (cm): 52.7
Shape: Slender

Location: Greyhound Yard
Phase: 100-200 AD
Region: South
Site Type: Urban

Pathology: Present
No Lesions: 3

(ID)	Key Lesions/Anomalies:			
99	Thoracic Vert	Shape Alteration	Unknown	Bowing
100	Ulna	Bone Formation	Congenital	Periostosis
101	Ulna	Bone Formation	Congenital	Periostosis

Key Dental:

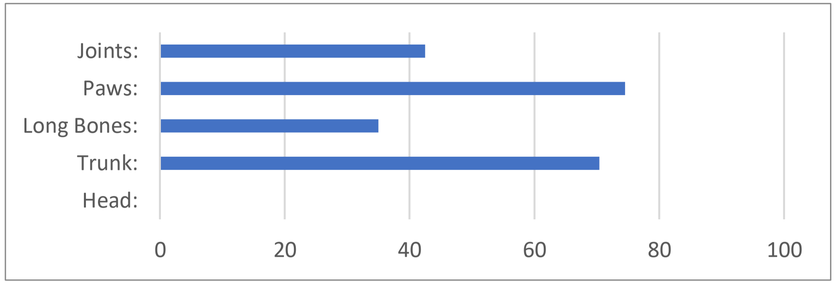
Age at Death: Young Adult

After Death:

Context Type: Cess Pit
Butchery: Absent
Preservation: Excellent
Gnawing: Absent

No. Bones (Ex. Ribs): 92
No Teeth: 0

Completeness:



Summary:

A large dog, but quite slender, which is an unusual combination. Lived sometime in the early-to-mid Roman period, it has an unusual spur on the distal end of both ulnae, possibly a congenital trait or unusual shape variation, as it was identical on both sides.

Summary:

Died sometime in early adulthood and then deposited in a cess pit. The bones, aside from the head, survived very well and with excellent preservation.

ID GY-10

During Life:

Sex:	Unknown	**Withers (cm):**	52.1
		Shape:	Slender
Location:	Greyhound Yard	**Region:**	South
Phase:	100-200 AD	**Site Type:**	Urban
Pathology:	Present	**No Lesions:**	2

(ID) Key Lesions/Anomalies:

102	Rib	Bone Formation	Trauma	Periostosis
103	Lumbar Verte	Shape Alteration	Unknown	Bowing

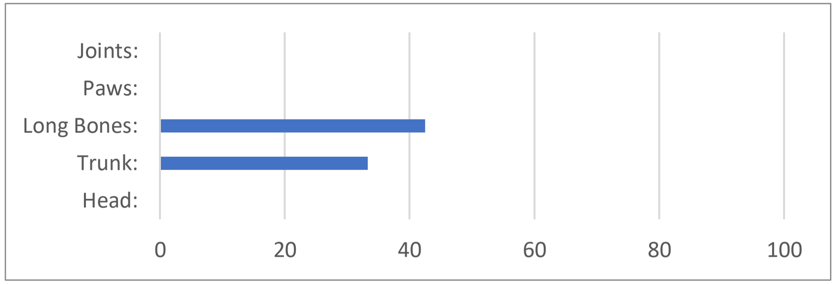
Key Dental:

Age at Death: Adult

After Death:

Context Type:	Cess Pit	**Butchery:**	Absent
Preservation:	Average	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	14	**No Teeth:**	0

Completeness:



Summary:

Also a tall, slender dog that lived from the early-to-mid Roman period. Subtle lesions are present: slight swelling on rib, possibly a result of trauma, and bowing of the spinous process in the vertebrae. Latter is a common issue in dogs of unknown cause.

Summary:

Died at an unknown age in adulthood, the dog was then buried in a cess pit. Only a modest number of bones survived, mainly the Long Bones, pelvis and vertebrae.

ID GY-11

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: 100-200 AD

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Young Adult

After Death:

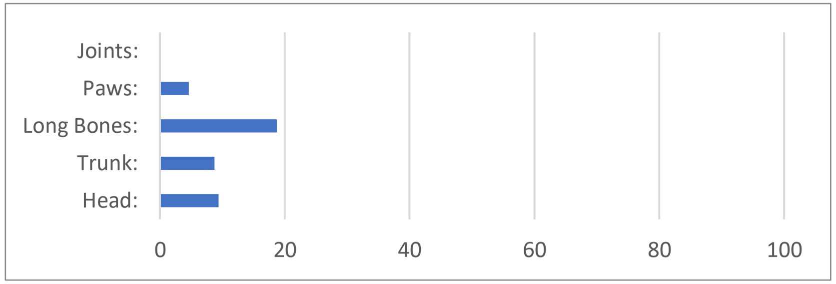
Context Type: Pit
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 9

No Teeth: 3

Completeness:



Summary:

Little is known about the dog's life, as it has no lesions and available data about its size and shape. It lived during the early-to-mid Roman period.

Summary:

The dog had an unusual survival pattern: aside from one vertebrae, only bones from the left side of the animal survive. As no butchery is present, this may be coincidence. Otherwise, it died as a young adult and was buried in a pit.

ID GY-12

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: 150-300 AD

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Adult

After Death:

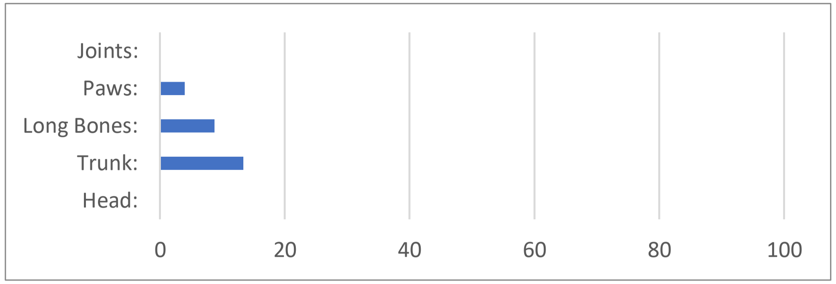
Context Type: Building
Preservation: Good

Butchery: Absent
Gnawing: Present

No. Bones (Ex. Ribs): 4

No Teeth: 0

Completeness:



Summary:

Another dog that has little biographic info, except for the approximate date it lived: around the Middle Roman period.

Summary:

Buried under a building after death sometime in adulthood, few bones survived. None from the head or joints were present. What bones were recovered, several showed signs of gnawing by scavengers.

ID GY-13

During Life:

Sex: Unknown

Withers (cm): 57.6
Shape: Slender

Location: Greyhound Yard
Phase: 75-120 AD

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) **Key Lesions/Anomalies:**

Key Dental:

Age at Death: Adult

After Death:

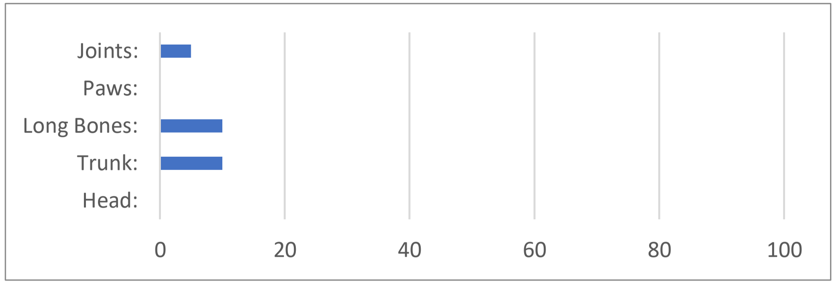
Context Type: Well
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 5

No Teeth: 0

Completeness:



Summary:

A very large dog, one of the largest in the sample, it also had a fairly slender build like a greyhound. It had no signs of pathology or abnormality, and lived during the Early Roman period.

Summary:

After dying at an unknown stage in adulthood, the dog was deposited in a well. Few bones survive, mainly ribs, in a reasonable condition.

ID GY-14

During Life:

Sex: Unknown

Withers (cm): 28.4
Shape: Robust

Location: Greyhound Yard
Phase: 75-120 AD

Region: South
Site Type: Urban

Pathology: Present

No Lesions: 3

(ID) Key Lesions/Anomalies:

104	Metatarsal	Bone Formation	Trauma	Ankylosis
105	Femur	Shape Alteration	Congenital	Bowing
106	Tibia	Shape Alteration	Congenital	Bowing

Key Dental:

Age at Death: Adult

After Death:

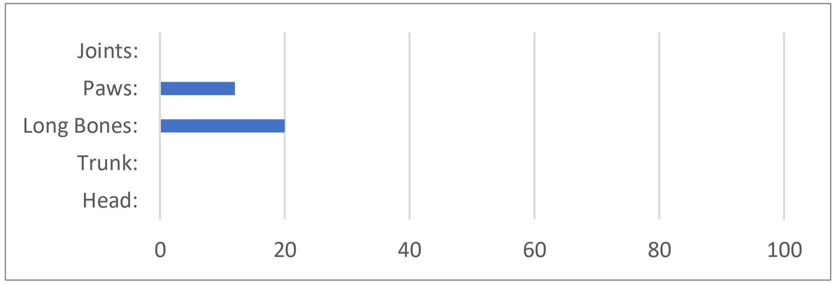
Context Type: Cess Pit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 5

No Teeth: 0

Completeness:



Summary:
A very small dog, with a robust build. Affected by congenital dwarfism, as shown by the short, twisted limbs. Showed early signs of bone fusion in the back paw, perhaps from trauma. Lived in the Ealy Roman period.

Summary:
Placed in the same cess pit as GY-15, GY-16 and GY-21 in the same approximate time period. They were likely deposited separately due to the difference in preservation. Only a couple of Long Bones and paw bones survive.

ID GY-15

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: 75-120 AD

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Adult

After Death:

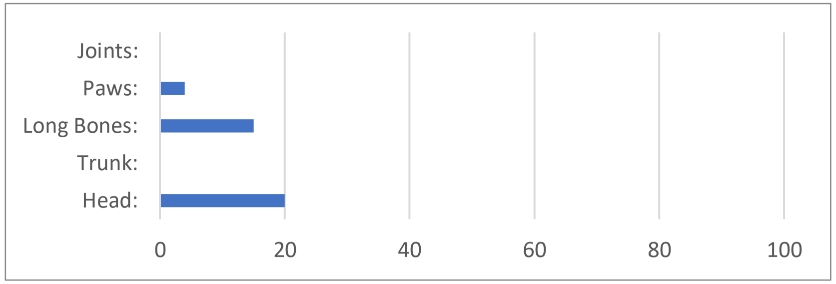
Context Type: Cess Pit
Preservation: Excellent

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 4

No Teeth: 0

Completeness:



Summary:

A dog with no lesions or physiological information, its life is a complete mystery. What is known is that it lived during the Early Roman period.

Summary:

Placed in the same cess pit as GY-15, GY-16 and GY-21 in the same approximate time period. They were likely deposited separately due to the difference in preservation. Part of the head survives, with a few paw and long bones.

ID GY-16

During Life:

Sex:	Unknown	**Withers (cm):**	Unknown
		Shape:	Unknown
Location:	Greyhound Yard	**Region:**	South
Phase:	75-120 AD	**Site Type:**	Urban
Pathology:	Absent	**No Lesions:**	0

(ID) Key Lesions/Anomalies:

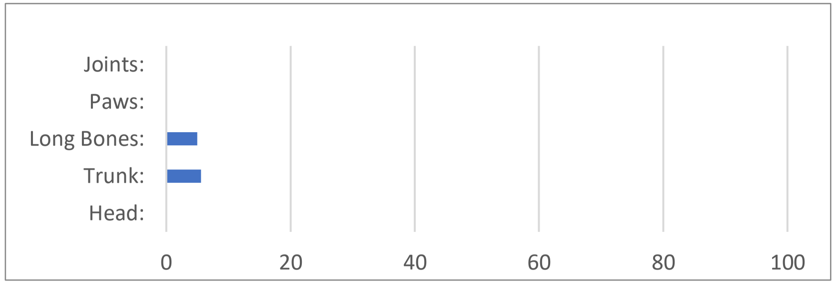
Key Dental:

Age at Death: Young Adult

After Death:

Context Type:	Cess Pit	**Butchery:**	Absent
Preservation:	Average	**Gnawing:**	Present
No. Bones (Ex. Ribs):	4	**No Teeth:**	0

Completeness:



Summary:

Lived during the Early Roman period, but nothing else is known about the dog's life. No lesions are present.

Summary:

Placed in the same cess pit as GY-15, GY-16 and GY-21 in the same approximate time period. They were likely deposited separately due to the difference in preservation. Only a few trunk and long bones are present, and indicate the dog died as a young adult.

ID GY-17

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: 150-300 AD

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Immature

After Death:

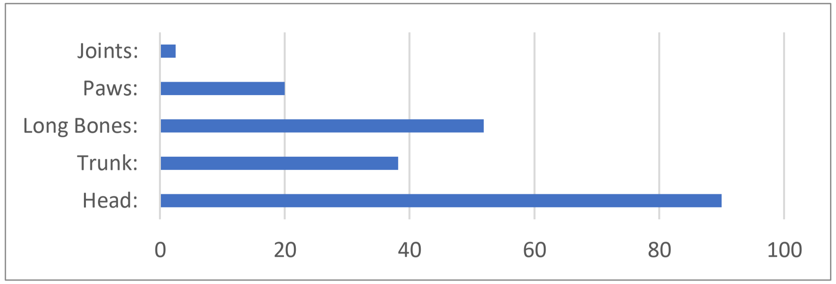
Context Type: Cess Pit
Preservation: Poor

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 25

No Teeth: 7

Completeness:



Summary:

Lived in the Middle Roman period or beginning of the Late, but nothing else about the dog when alive is known.

Summary:

Died when young: many bones unfused. While a good number of bones were recovered, most were poorly preserved. The head is the exception, with most of the skull surviving. Most of the long bones recovered had missing epiphyses.

ID GY-18

During Life:

Sex: Unknown
Withers (cm): 57.6
Shape: Slender

Location: Greyhound Yard
Phase: 75-120 AD
Region: South
Site Type: Urban

Pathology: Absent
No Lesions: 0

(ID) **Key Lesions/Anomalies:**

Key Dental:

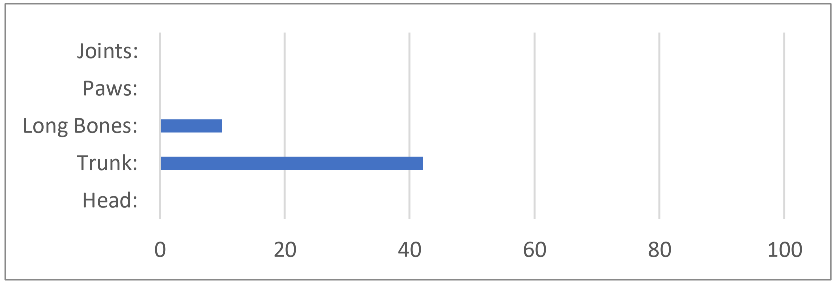
Age at Death: Adult

After Death:

Context Type: Well
Preservation: Average
Butchery: Present
Gnawing: Absent

No. Bones (Ex. Ribs): 18
No Teeth: 0

Completeness:



Summary:

Very tall but slender dog that lived in the Early Roman period. No lesions were present, indicating good health and/or young age.

Summary:

Died when an adult, but at an otherwise unknown age. Reasonably well preserved, but most bones lost. While butchery is noted as present, cannot be guaranteed: ribs are heavily fragmented and may come from sheep.

ID GY-19

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: 150-300 AD
Region: South
Site Type: Urban

Pathology: Absent
No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

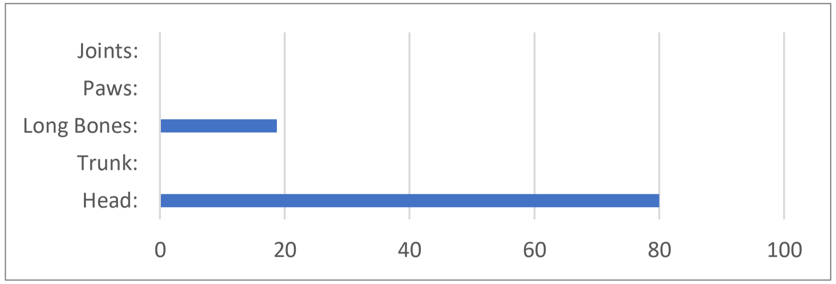
Age at Death: Immature

After Death:

Context Type: Cess Pit
Preservation: Poor
Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 7
No Teeth: 9

Completeness:



Summary:

Aside from when it lived, in the Middle Roman period, this dog's life is impossible to discern. It had not finished growing, and had no lesions.

Summary:

Died extremely young - the head was well preserved, and showed that the dog had no adult teeth. Otherwise, little of it survived aside from a few long bones. The skeleton was deposited in a cess pit.

ID GY-20

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: 250-400 AD
Region: South
Site Type: Urban

Pathology: Present
No Lesions: 1

(ID) Key Lesions/Anomalies:

(ID)	Bone	Lesion	Cause	Type
108	Femur	Fracture	Trauma	Oblique

Key Dental:

(ID)	Tooth	Condition
33	M1	Cavity
35	Maxilla	Significant Alveolar Recession

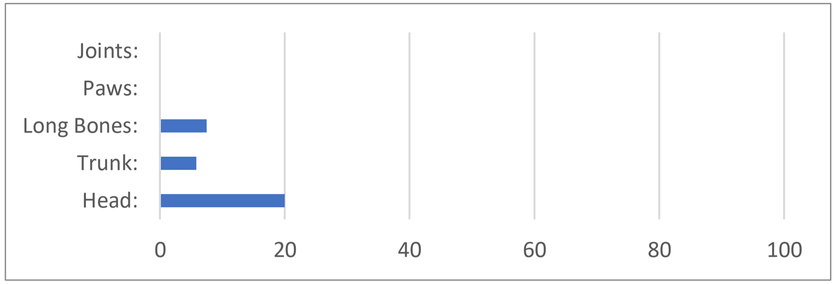
Age at Death: Adult

After Death:

Context Type: Gulley
Butchery: Absent
Preservation: Average
Gnawing: Present

No. Bones (Ex. Ribs): 3
No Teeth: 7

Completeness:



Summary:

Dating across the mid-to-late Roman period, the dog had fractured its back leg during life. The bone healed, but the distal half healed at an awkward angle and was displaced from the rest. Aside from this, the dog had gum disease and cavities.

Summary:

Few bones survive, which were recovered from a gulley. The dog's skeleton, which indicated it died as an adult, also showed signs of gnawing by scavengers.

ID GY-21

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Greyhound Yard
Phase: 75-120 AD

Region: South
Site Type: Urban

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Newborn

After Death:

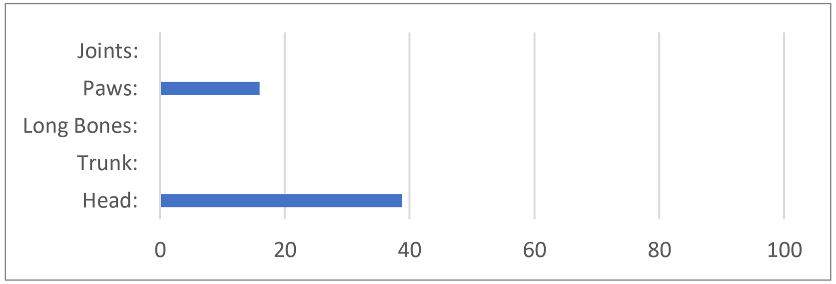
Context Type: Cess Pit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 6

No Teeth: 4

Completeness:



Summary:

Very little known about the dog's life, aside from the fact it lived in the Early Roman period.

Summary:

Placed in the same cess pit as GY-15, GY-16 and GY-21 in the same approximate time period. They were likely deposited separately due to the difference in preservation. The dog died very young, but sometime after its deciduous teeth had erupted (c. 6 weeks).

ID HD-1

During Life:

Sex:	Male	**Withers (cm):**	54.1
		Shape:	Medium
Location:	Houghton Down	**Region:**	South
Phase:	EIA	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	4

(ID) Key Lesions/Anomalies:

(ID)				
221	Radiale	Bone Formation	Arthropathy	Osteophyte
222	Thoracic Vert	Bone Formation	Arthropathy	Enthesophyte
223	Lumbar Verte	Shape Alteration	Unknown	Bowing
224	Lumbar Verte	Shape Alteration	Unknown	Bowing

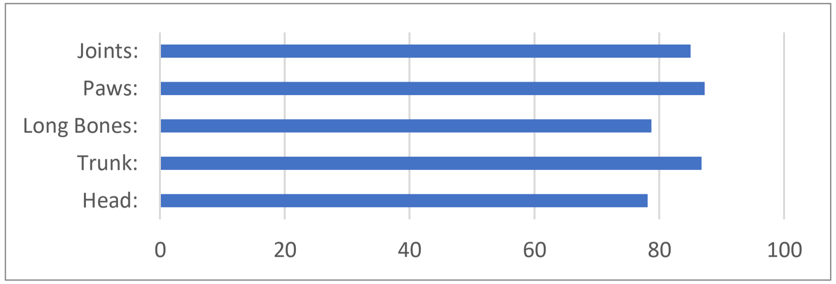
64	**Key Dental:** uC		Calculus
65	uM2		Calculus

Age at Death: Young Adult

After Death:

Context Type:	Pit	**Butchery:**	Absent
Preservation:	Average	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	125	**No Teeth:**	21

Completeness:



Summary:

One of the few dogs with a baculum, confirming it was male. Dating to the Early Iron Age, he was a large animal with a few small lesions linked with age. Calculus was found on two of the teeth, also suggesting a slightly older animal.

Summary:

Tooth wear contrasts with pathology, and suggests the dog died as a young adult: actual death age is a mystery. Otherwise, the dog survived very well in terms of the number of bones, although many bones were abraded. The skull was exceptionally well preserved.

ID HD-2

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Houghton Down
Phase: EIA

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Immature

After Death:

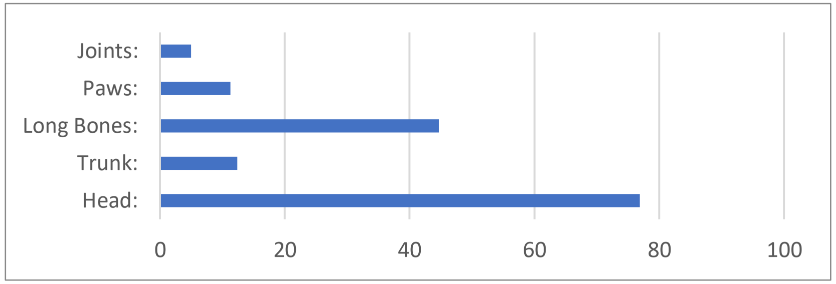
Context Type: Pit
Preservation: Good

Butchery: Present
Gnawing: Absent

No. Bones (Ex. Ribs): 24

No Teeth: 12

Completeness:



Summary:

The dog lived in the Early Iron Age, but nothing else is known about its life. No pathology is present, and details about its size and sex are unknown.

Summary:

The dog died rather young, as many of its bones were unfused. Even before reaching its adult height, however, the bones were rather large. It was heavily butchered, with unique patterns suggesting both skinning and disembowellment.

ID LS-1

During Life:

Sex: Unknown
Withers (cm): 47.1
Shape: Medium

Location: Little Somborne
Region: South
Phase: IA
Site Type: Rural

Pathology: Present
No Lesions: 3

(ID) Key Lesions/Anomalies:

ID				
225	Caudal Vertel	Size Alteration	Congenital	Enlarged
226	Lumbar Verte	Shape Alteration	Unknown	Bowing
227	Sacrum	Shape Alteration	Unknown	Bowing

Key Dental:

52	P1	Ante-Mortem Tooth Loss, Nearly Healed
53	M1	Cavity

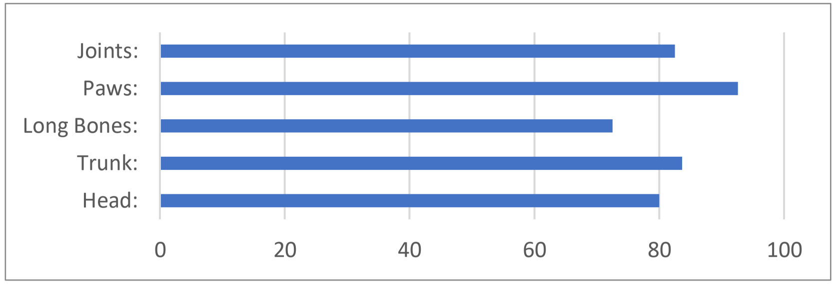
Age at Death: Older Adult

After Death:

Context Type: Pit
Butchery: Absent
Preservation: Poor
Gnawing: Absent

No. Bones (Ex. Ribs): 120
No Teeth: 32

Completeness:



Summary:

Lived sometime in the Iron Age, the dog was medium-to-large size. The caudal vertebrae were assymmetric, possibly a congenital trait. A premolar was lost before death, likely knocked out: a small fragment of tooth remained in the socket.

Summary:

The dog was rather old when it died, and all teeth were heavily worn. Although many bones survived, their condition was dreadful: covered in deposits and poorly cleaned.

ID NC-1

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Nettlebank Copse
Phase: LIA
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 3

(ID) Key Lesions/Anomalies:

30 Axis	Bone Formation	Trauma	Periostosis
31 Scapula	Bone Formation	Trauma	Periostosis

6 **Key Dental:**	M3	Ante-Mortem Tooth Loss
7	Mandible	Calculus, Alveolar Recession

Summary:

Little is known about the dog's size, but it had an eventful life. There are several lesions on the upper spine and shoulder that suggest trauma, and a tooth was lost before death. The latter may be due to a blow or dental disease in the whole mouth.

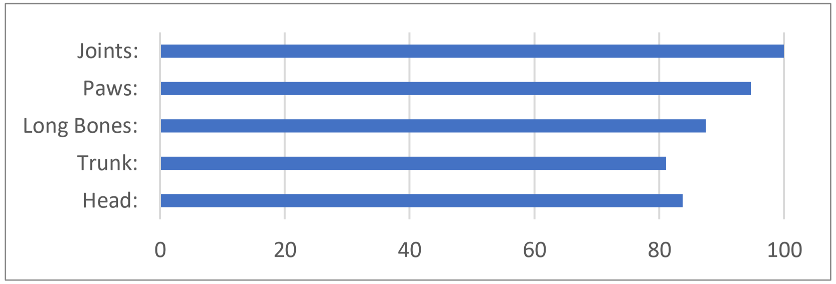
Age at Death: Subadult

After Death:

Context Type: Ditch
Butchery: Absent
Preservation: Excellent
Gnawing: Present

No. Bones (Ex. Ribs): 140
No Teeth: 39

Completeness:



Summary:

Died just before reaching adulthood, as the majority of bones were fused. Unusually for an Iron Age dog, it was deposited in a ditch and not a pit. The skeleton survived extremely well, one of the best of the whole group, despite the fact it was gnawed by scavengers.

ID NC-2

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Nettlebank Copse
Phase: EIA
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 1

(ID) Key Lesions/Anomalies:

(ID)	Element	Lesion	Category	Type
33	Tibia	Shape Alteration	Congenital	Other

Key Dental:

(ID)	Element	Lesion
9	Mandible	Alveolar Recession
10	M2	Cavity

Summary:

Although the dog's size and shape are unknown, it had an unusual physical feature: part of the back leg bones was unusually shaped. This may be an inherited feature. Otherwise, it had slight dental disease and a small cavity in one molar.

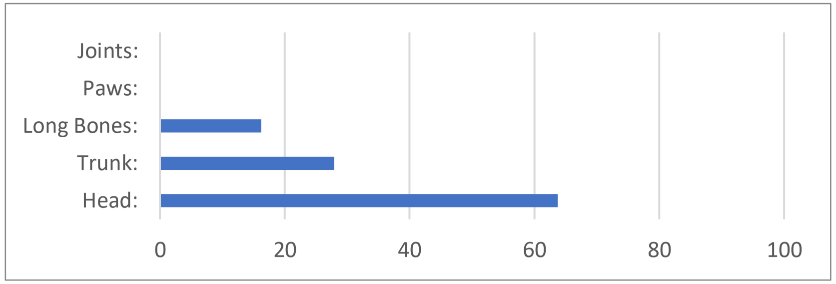
Age at Death: Subadult

After Death:

Context Type: Pit
Butchery: Present
Preservation: Good
Gnawing: Absent

No. Bones (Ex. Ribs): 15
No Teeth: 0

Completeness:



Summary:

Died just before reaching maturity, as nearly all bones were fused. The body was butchered before being deposited in a pit, likely to obtain the skin and pelt. The head survived well, but otherwise many bones were lost.

ID OAK-1

During Life:

Sex: Unknown
Withers (cm): 44.5
Shape: Medium

Location: Oakridge Well
Phase: Late Roman
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 4

(ID) Key Lesions/Anomalies:

(ID)				
44	Pelvis	Bone Formation	Arthropathy	Enthesophyte
45	Lumbar Verte	Shape Alteration	Unknown	Bowing
46	Lumbar Verte	Shape Alteration	Unknown	Bowing
47	Thoracic Vert	Shape Alteration	Unknown	Bowing

11 **Key Dental:** M1 0

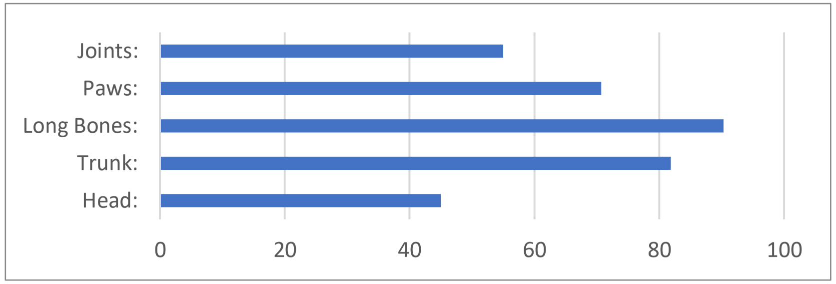
Age at Death: Young Adult

After Death:

Context Type: Well
Butchery: Absent
Preservation: Good
Gnawing: Present

No. Bones (Ex. Ribs): 92
No Teeth: 28

Completeness:



Summary:

A medium sized dog that lived during the Late Roman period. Many of the vertebrae had bowed spinous processes, a common anomaly, but the cause is unknown. The growth on the pelvis is likely related to age.

Summary:

The dog died at a young age as shown by fusion lines on the skeleton. Thus, the pelvis lesion may have been caused by muscular strain or imbalances. The body was deposited in a massive well, but was gnawed sometime before burial under other well deposits.

ID OAK-2

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Oakridge Well
Phase: Late Roman

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) **Key Lesions/Anomalies:**

Key Dental:

Summary:

Very little is known about the dog, except that it lived during the end of the Roman occupation. No pathology or abormalities were found.

Age at Death: Immature

After Death:

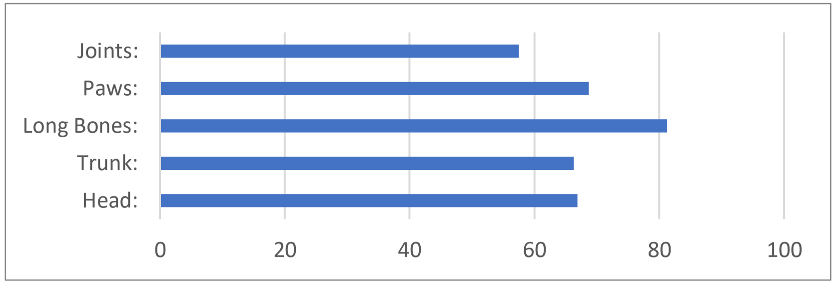
Context Type: Well
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 84

No Teeth: 13

Completeness:



Summary:

A very young dog when it died, most of its bones were unfused. Deposited in a huge well, the skeleton survived well. All parts of the skeleton were recovered to a similar degree.

ID OAK-3

During Life:

Sex: Unknown

Withers (cm): 35.1
Shape: Slender

Location: Oakridge Well
Phase: Late Roman

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 1

(ID) Key Lesions/Anomalies:

48	Rib	Bone Formation	Trauma	Periostosis

12	**Key Dental:**	Mandible	Recession
13		M3	Congenitally Absent

Summary:

Unusually for a small dog, its build was very slender: most others had thick, twisted limbs associated with dwarfism. This small size led to the loss of the third molar due to a lack of jaw space. Its rib was slightly swollen, perhaps from a minor injury.

Age at Death: Young Adult

After Death:

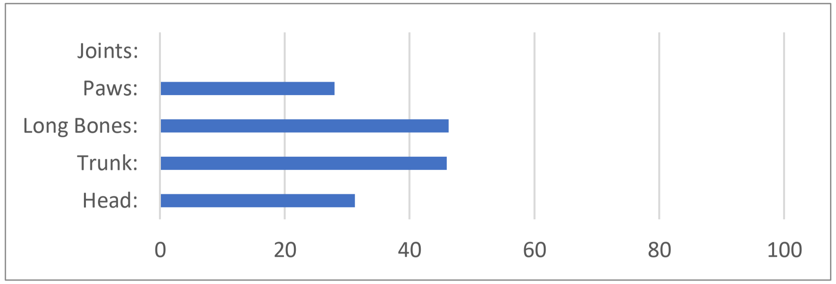
Context Type: Well
Preservation: Excellent

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 23

No Teeth: 9

Completeness:



Summary:

Died sometime in early adulthood, the body was deposited in a huge well. At some point, half of the body was displaced slightly away from the other, as they were found in adjacent layers. The two halves matched perfectly.

ID OAK-4

During Life:

Sex: Unknown

Withers (cm): 56
Shape: Medium

Location: Oakridge Well
Phase: Late Roman

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Young Adult

After Death:

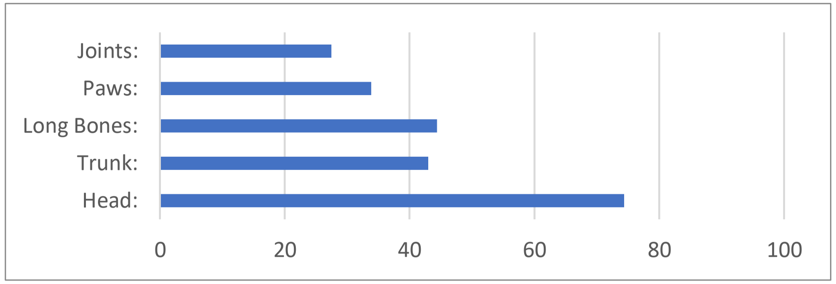
Context Type: Well
Preservation: Good

Butchery: Absent
Gnawing: Present

No. Bones (Ex. Ribs): 22

No Teeth: 19

Completeness:



Summary:

A very large dog of medium build, but massive jaw, it lived during the end of the Roman occupation. No lesions were present on the skeleton, indicating that it may have been in good health during its life.

Summary:

Died in early adulthood, it was deposited in a massive well shaft. The skeleton survived fairly well, although it was gnawed by scavengers before final burial.

ID OW-1

During Life:

Sex: Unknown
Withers (cm): 49.9
Shape: Slender

Location: Owslebury
Phase: 1st AD
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 8

(ID) Key Lesions/Anomalies:

(ID)	Bone	Lesion	Category	Type
109	Tibia	Bone Destruction	Congenital	Articular Groove
110	Tibia	Bone Destruction	Congenital	Articular Groove
111	Humerus	Bone Destruction	Arthropathy	Cavity
112	Humerus	Bone Formation	Arthropathy	Enthesophyte
113	Rib	Bone Formation	Arthropathy	Extension of Bone Ridge

36 **Key Dental:** M3 Congenitally Absent

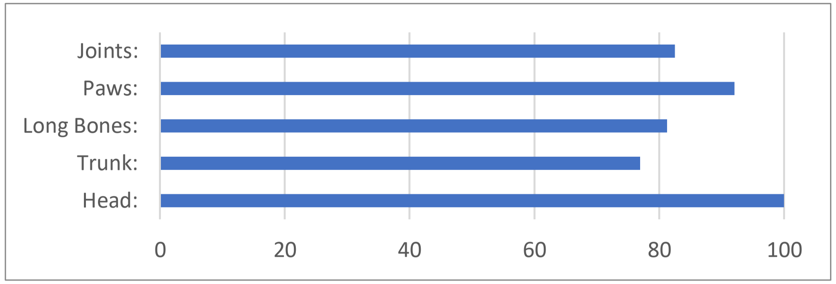
Age at Death: Older Adult

After Death:

Context Type: Ditch
Butchery: Absent
Preservation: Excellent
Gnawing: Absent

No. Bones (Ex. Ribs): 116
No Teeth: 29

Completeness:



Summary:

A fairly large, slender dog that lived during the earliest part of the Roman period. Unusually for a large dog, the third molar was congenitally absent. Otherwise, it had several lesions suggesting advanced age and an unusual set of grooves.

Summary:

Died when fairly old, the dog was deposited in a ditch. The skeleton survived exceedingly well, perhaps one of the best of the entire sample. The skull survived completely intact, with most of the teeth.

ID OW-2

During Life:

Sex: Unknown
Withers (cm): 46.1
Shape: Medium

Location: Owslebury
Phase: 4th AD
Region: South
Site Type: Rural

Pathology: Absent
No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

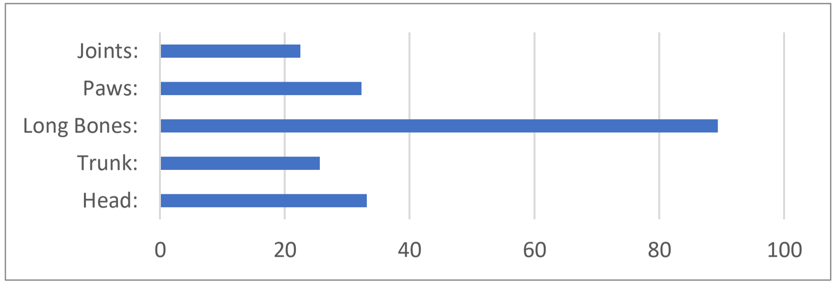
Age at Death: Adult

After Death:

Context Type: Cess Pit
Preservation: Good
Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 36
No Teeth: 0

Completeness:



Summary:

Lived during the Late Roman period, the dog was of medium-to-large size and medium build. No lesions or abnormalities are present.

Summary:

With a fairly well preserved skeleton, with both large and small bones surviving, the dog was recovered from the same cess pit as OW-3. It had died sometime in adulthood, but otherwise the timing is unknown. No signs of disturbance by humans or scavengers.

ID OW-3

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Immature

After Death:

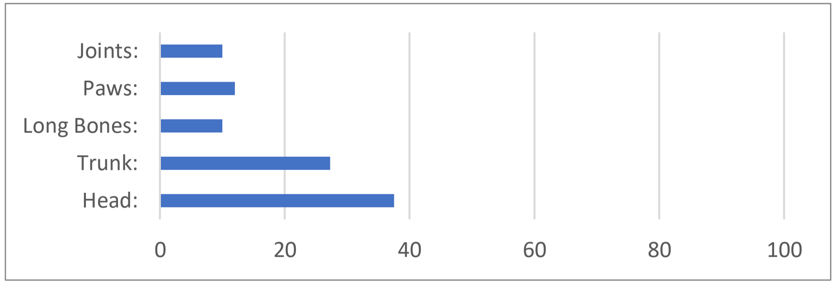
Context Type: Cess Pit
Preservation: Good

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 18

No Teeth: 3

Completeness:



Summary:

Dating to the Late Romen period, little else is known about the dog when it was alive. No lesions are present, and the bones could not be measured for size or shape.

Summary:

Dog was very young when it died, as most bones were unfused. Deposited in the same cess pit as OW-2, it is unknown if these burials were linked.

ID OW-4

During Life:

Sex: Male

Withers (cm): 43.4
Shape: Medium

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 1

(ID) Key Lesions/Anomalies:

117 Femur — Bone Formation — Arthropathy — Enthesophyte

Key Dental:

Age at Death: Adult

After Death:

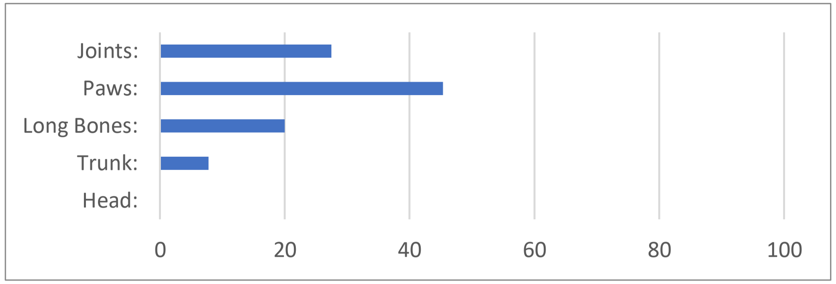
Context Type: Cess Pit
Preservation: Excellent

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 43

No Teeth: 0

Completeness:



Summary:

A medium-sized dog of average build, and one of the few that has a baculum and is definitely male. Slight growth on femur suggests the dog was not particularly young, and was starting to age when it died.

Summary:

The dog died sometime in adulthood, and was deposited in a cess pit. Interesting taphonomy may have affected the skeleton: most of the bones are in excellent condition, but a few were heavily abraded.

ID OW-5

During Life:

Sex: Unknown
Withers (cm): 48.7
Shape: Medium

Location: Owslebury
Phase: 4th AD
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 7

(ID) Key Lesions/Anomalies:

119	Ulna	Bone Formation	Congenital	Extension of Bone Ridge
120	Caudal Vertel	Bone Formation	Congenital	Periostosis
121	Lumbar Verte	Shape Alteration	Unknown	Bowing

37 **Key Dental:** M3 Extra Cusp/Root

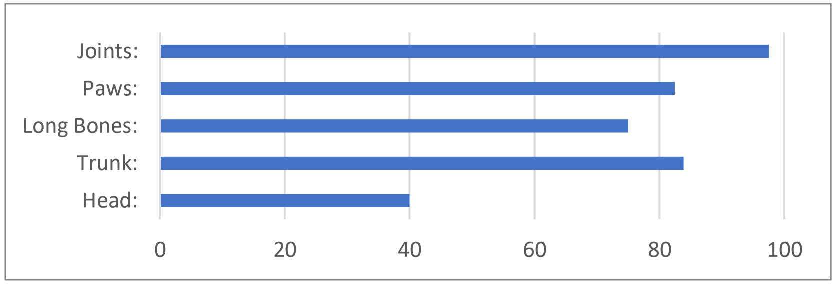
Age at Death: Young Adult

After Death:

Context Type: Cess Pit
Butchery: Absent
Preservation: Good
Gnawing: Absent

No. Bones (Ex. Ribs): 132
No Teeth: 9

Completeness:



Summary:

Lived during the Late Roman period, the dog was medium-to-large in size and of average build. Many of its vertebrae had bowed spinous processes, as do many dogs, but the cause is unknown. A few shape anomalies are present, possibly inherited.

Summary:

The dog died fairly young, but when it was an adult. Most of the skeleton survives, save for the head, which is rather fragmented. Like many dogs at Owslebury, it was deposited in a cess pit.

ID OW-6

During Life:

Sex: Male
Withers (cm): Unknown
Shape: Unknown

Location: Owslebury
Phase: 4th AD
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 1

(ID) Key Lesions/Anomalies:

125 Thoracic Vert Bone Formation — Trauma — Periostosis

Key Dental:

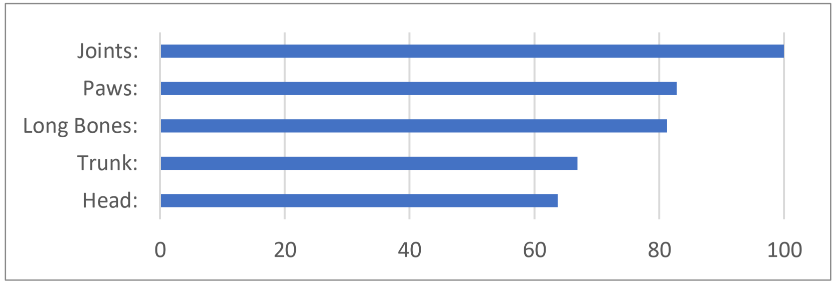
Age at Death: Juvenile

After Death:

Context Type: Cess Pit
Preservation: Good
Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 119
No Teeth: 36

Completeness:



Summary:

The dog was male, but of unknown size and build. A small lesion on a vertebra suggests minor trauma sometime during its life, but not too close to death. Lived during the Late Roman period.

Summary:

Died when quite young, as many of the long bones had not yet fused. Deposited in a cess pit, the skeleton survived extremely well, and all small joint bones survived. Unfortunately, the skull was badly damaged.

ID OW-7

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Owslebury
Phase: 3rd-4th AD

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Young Adult

After Death:

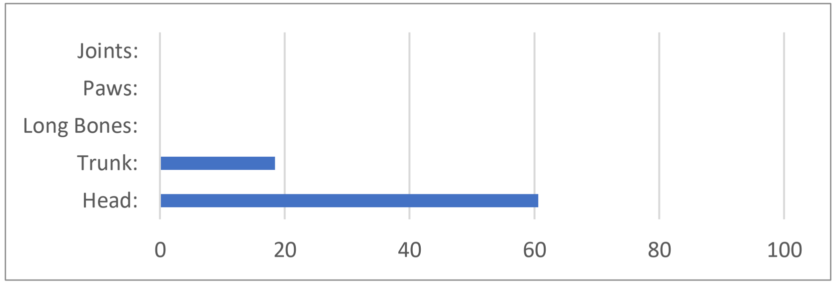
Context Type: Ditch
Preservation: Poor

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 7

No Teeth: 16

Completeness:



Summary:

Lived during the mid-to-late Roman period, but little else is known about the life of the dog. No lesions or anomalies were found on the skeleton.

Summary:

Died when a young adult, and placed in a ditch. From here, the skeleton survived poorly: most bones were lost and the bones were heavily damaged by root etching. However, scavengers did not disturb the skeleton.

ID OW-8

During Life:

Sex: Unknown

Withers (cm): 46.2
Shape: Robust

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 4

(ID) Key Lesions/Anomalies:

126	Rib	Bone Formation	Trauma	Periostosis
127	Rib	Bone Formation	Trauma	Periostosis
128	Proximal Pha	Size Alteration	Trauma	Enlarged
129	Humerus	Fracture	Trauma	Oblique

Key Dental:

Age at Death: Older Adult

After Death:

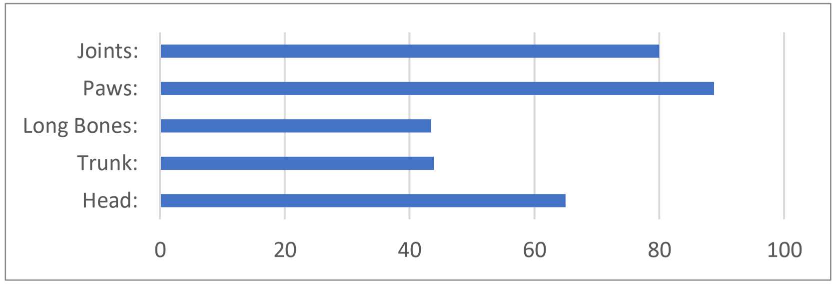
Context Type: Ditch
Preservation: Poor

Butchery: Present
Gnawing: Present

No. Bones (Ex. Ribs): 102

No Teeth: 13

Completeness:



Summary:

A medium-to-large sized dog, of robust build, it lived during the Late Roman period. Several traumatic lesions were found, in particular a foreleg fracture that healed with huge foreshortening making one leg permanently shorter than the other.

Summary:

Died as an older adult, indicating the dog may have lived with its unusual leg for a long time. While many bones were recovered from the ditch, the condition of these were poor. They were gnawed, and a femur was cut at its end, suggesting skinning.

ID OW-9

During Life:

Sex: Unknown

Withers (cm): Unknown
Shape: Unknown

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Absent

No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

Age at Death: Immature

After Death:

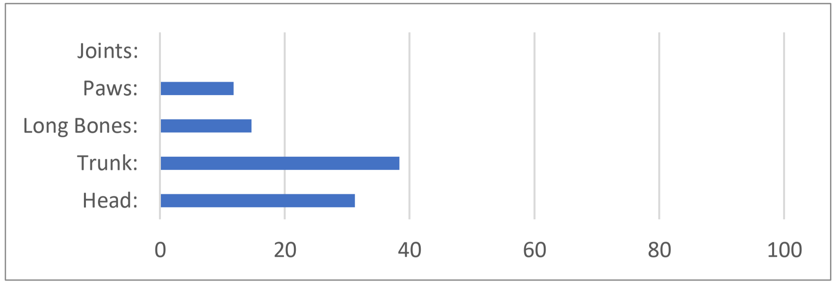
Context Type: Cess Pit
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 29

No Teeth: 10

Completeness:



Summary:

Aside from living in the Late Roman period, nothing can be discerned about the dog's life. Pathology and other anomalies were absent.

Summary:

Died when very young, the long bones were unfused. After burial in a cess pit, a modest number of bones survived. These were mainly from the head and trunk.

ID OW-10

During Life:

Sex: Male

Withers (cm): 39.2
Shape: Robust

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 10

(ID) Key Lesions/Anomalies:

(ID)	Element	Type	Category	Description
130	Pelvis	Bone Formation	Arthropathy	Osteophyte
131	Proximal Pha	Bone Formation	Arthropathy	Enthesophyte
132	Radius	Shape Alteration	Congenital	Bowing
135	Humerus	Bone Formation	Arthropathy	Extension of Bone Ridge
137	Ulna	Bone Formation	Arthropathy	Enthesophyte
139	Radius	Bone Formation	Arthropathy	Extension of Bone Ridge

Key Dental:

Age at Death: Older Adult

After Death:

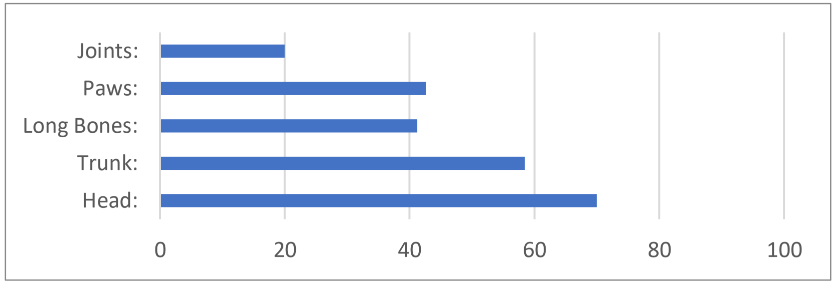
Context Type: Cess Pit
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 59

No Teeth: 15

Completeness:



Summary:

A small male dog, its build was robust. The limbs were short, broad and twisted, indicating congenital dwarfism. It was affected by a large number of age-related lesions, suggesting old age and possible osteoarthritis, or at least a precursor.

Summary:

As with many other Owslebury dogs, its final resting place was a cess pit. Given the high number of age-related lesions, the dog likely lived a long life. Bone survival was good, with bones of all areas and sizes represented.

ID OW-11

During Life:

Sex:	Unknown	**Withers (cm):**	Unknown
		Shape:	Unknown
Location:	Owslebury	**Region:**	South
Phase:	IA	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	3

(ID) Key Lesions/Anomalies:

141 Rib	Bone Formation	Disease	Periostosis
142 Rib	Bone Formation	Disease	Periostosis
143 Rib	Bone Formation	Disease	Periostosis

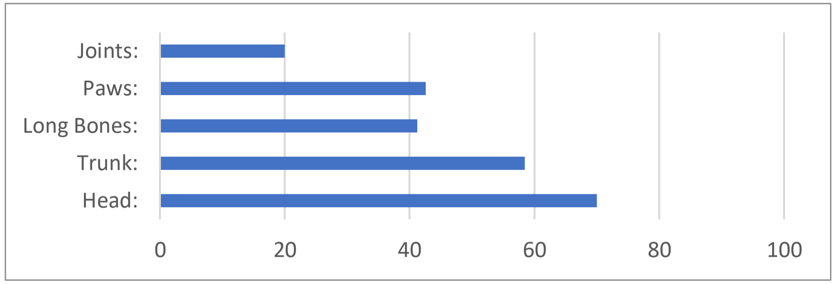
38 **Key Dental:** Mandible Alveolar Recession

Age at Death: Subadult

After Death:

Context Type:	Pit	**Butchery:**	Absent
Preservation:	Average	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	93	**No Teeth:**	41

Completeness:



Summary:

One of the few dogs in Owslebury that lived in the Iron Age, it suffered from slight peridontal disease and some unusual lesions around the rib. Local infection or inflammation is possible, and may have been painful.

Summary:

Died when it was close to reaching adulthood. The skeleton was deposited in a pit, similar to many Iron Age skeletons. A high number of bones survived in reasonable condition.

ID OW-12

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Owslebury
Phase: 4th AD
Region: South
Site Type: Rural

Pathology: Absent
No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

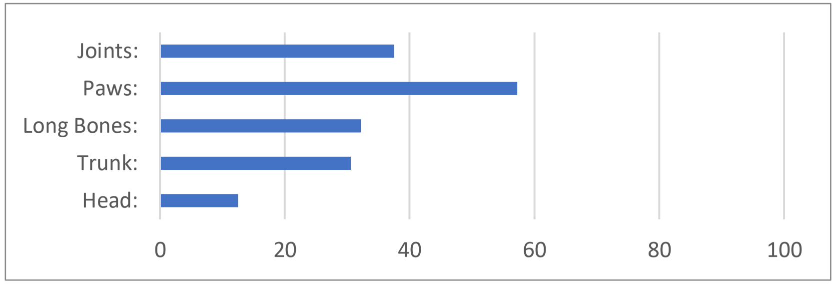
Age at Death: Young Adult

After Death:

Context Type: Ditch
Preservation: Poor
Butchery: Absent
Gnawing: Present

No. Bones (Ex. Ribs): 63
No Teeth: 11

Completeness:



Summary:

Lived during the Late Roman period, little else is known about the dog when alive. No lesions were found, which may suggest good health throughout its life.

Summary:

Died as a young adult, the body was gnawed by scavengers sometime before final burial. The skeleton was found in a ditch and, although many bones survived, they were all heavily abraded and fragmented.

ID OW-13

During Life:

Sex: Unknown

Withers (cm): 35.0
Shape: Robust

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 10

(ID) Key Lesions/Anomalies:

(ID)	Bone	Type	Cause	Lesion
145	Radius	Shape Alteration	Congenital	Bowing
146	Tibia	Shape Alteration	Congenital	Bowing
148	Femur	Shape Alteration	Congenital	Bowing
150	Humerus	Shape Alteration	Congenital	Bowing
152	Humerus	Bone Formation	Unknown	Periostosis
230	Humerus	Bone Formation	Unknown	Other

Key Dental:

Age at Death: Adult

After Death:

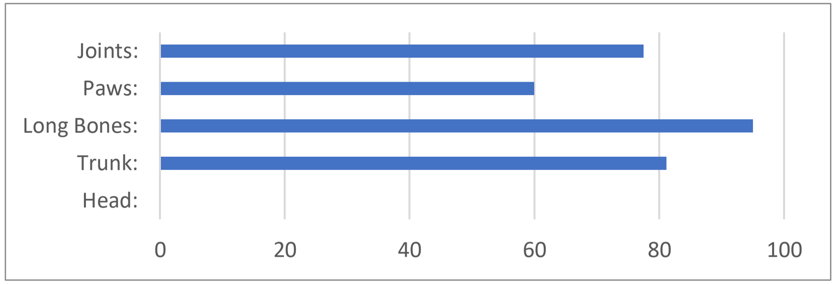
Context Type: Quarry
Preservation: Excellent

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 114

No Teeth: 1

Completeness:



Summary:

A small dog that had the short, highly twisted limbs of congenital dwarfism. Osteopetrosis, or unusual growth of bone in the hollow space, was found in a leg bone (Appendix C). The cause is unknown, possibly a disease or severe congenital condition.

Summary:

Died at an unknown age in adulthood, perhaps linked to its unusual lesions. Buried in a quarry, the skeleton survived extremely well except for the head.

ID OW-14

During Life:

Sex:	Unknown	**Withers (cm):**	49.6
		Shape:	Slender
Location:	Owslebury	**Region:**	South
Phase:	Unknown	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	15

(ID) Key Lesions/Anomalies:

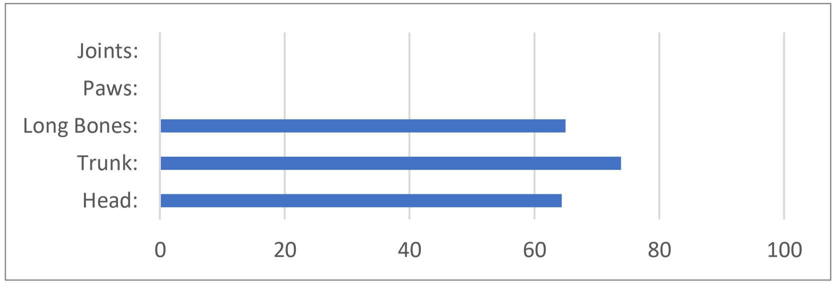
153	Mandible	Bone Formation	Trauma	Enthesophyte
154	Cranium	Bone Formation	Arthropathy	Enthesophyte
155	Femur	Bone Formation	Arthropathy	Enthesophyte
157	Radius	Bone Formation	Arthropathy	Enthesophyte
158	Sacrum	Shape Alteration	Unknown	Bowing
159	Lumbar Verte	Shape Alteration	Unknown	Bowing
40	**Key Dental:** Mandible		Alveolar Recession	
41	Maxilla		Alveolar Recession	

Age at Death: Young Adult

After Death:

Context Type:	Unknown	**Butchery:**	Present
Preservation:	Average	**Gnawing:**	Present
No. Bones (Ex. Ribs):	42	**No Teeth:**	20

Completeness:



Summary:

A large but slender dog, it was one of the few that could not be dated due to context issues. The spinal processes were bowed, and both age and traumatic lesions were found. The dog may have suffered a minor injury during a life that was probably long.

Summary:

Curiously, the tooth wear data suggests the dog died as a young adult. Thus, either the dog had a soft diet or was unfortunate enough to suffer from lesions usually found in older dogs. The context type cannot be confirmed, but was likely a pit.

ID OW-15

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Owslebury
Region: South
Phase: Unknown
Site Type: Rural

Pathology: Present
No Lesions: 1

(ID) Key Lesions/Anomalies:

(ID)	Element			
169	Pelvis	Bone Formation	Arthropathy	Enthesophyte

Key Dental:

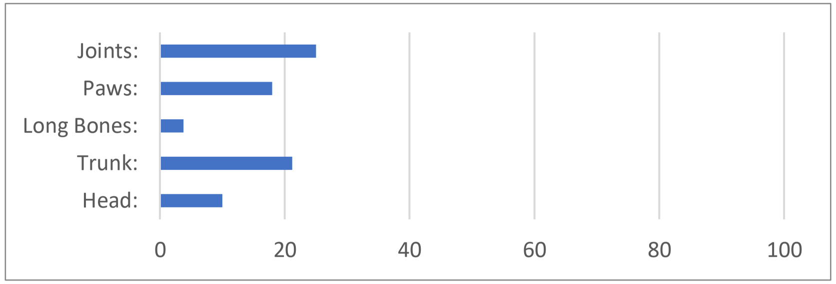
Age at Death: Adult

After Death:

Context Type: Pit
Butchery: Absent
Preservation: Average
Gnawing: Present

No. Bones (Ex. Ribs): 21
No Teeth: 0

Completeness:



Summary:

One of the rare dogs that lived during an unknown phase, due to context issues. Little is known about it, except that it may have been an older animal due to the slight growth on its pelvis.

Summary:

Died at some unknown point in adulthood and buried in a pit. Scavengers gnawed on the body or skeleton sometime before final burial. A small number of bones survived, but from all areas of the skeleton.

ID OW-16

During Life:

Sex: Unknown

Withers (cm): 42
Shape: Medium

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 5

(ID) Key Lesions/Anomalies:

(ID)				
170	Lumbar Verte	Shape Alteration	Unknown	Bowing
171	Lumbar Verte	Shape Alteration	Unknown	Bowing
172	Lumbar Verte	Shape Alteration	Unknown	Bowing
173	Thoracic Vert	Shape Alteration	Unknown	Bowing
174	Thoracic Vert	Shape Alteration	Unknown	Bowing

43 **Key Dental:** P2 Abscess

Age at Death: Young Adult

After Death:

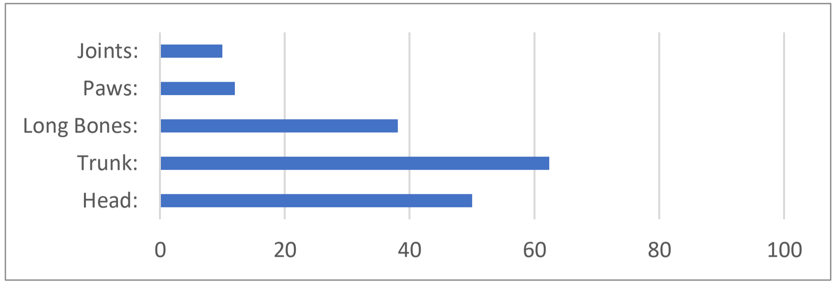
Context Type: Cess Pit
Preservation: Good

Butchery: Absent
Gnawing: Present

No. Bones (Ex. Ribs): 38

No Teeth: 7

Completeness:



Summary:

A medium sized dog of average build that lived during the Late Roman period. Most of the vertebrae had bowing on the spinal processes: the cause is unknown, but degree of bowing varied across bones. Suffered from a probable abscess in one tooth.

Summary:

Died as a young adult, and deposited in a cess pit. The body was gnawed on by scavengers, but still survived fairly well to the present day.

ID OW-17

During Life:

Sex: Unknown

Withers (cm): 43.2
Shape: Slender

Location: Owslebury
Phase: 4th AD

Region: South
Site Type: Rural

Pathology: Present

No Lesions: 3

(ID) Key Lesions/Anomalies:

(ID)				
175	Lumbar Verte	Shape Alteration	Unknown	Bowing
176	Caudal Vertel	Size Alteration	Congenital	Enlarged
177	Tarsal IV	Bone Formation	Trauma	Enthesophyte

Key Dental:

Age at Death: Adult

After Death:

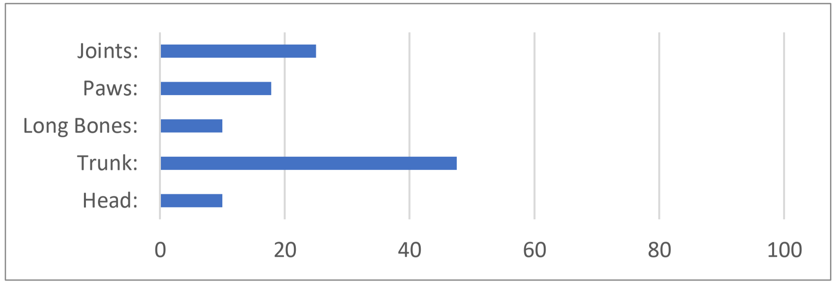
Context Type: Cess Pit
Preservation: Average

Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 45

No Teeth: 2

Completeness:



Summary:

A medium-sized dog of slim build, it lived during the Late Roman period. Like many other dogs, the spinal process is bowed. Otherwise, a small lesion on the paw suggests a minor injury and an odd assymmetry in the caudal vertebrae may been congenital.

Summary:

Buried in a cess pit, similarly to many other Owslebury dogs, it died sometime in adulthood. The skeleton survived reasonably well, although the trunk is the best preserved part.

ID OW-18

During Life:

Sex:	Unknown	**Withers (cm):**	Unknown
		Shape:	Unknown
Location:	Owslebury	**Region:**	South
Phase:	4th AD	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	3

(ID) Key Lesions/Anomalies:

(ID)	Element	Lesion	Cause	Type
178	Rib	Fracture	Trauma	Oblique
179	Thoracic Vert	Bone Formation	Trauma	Osteophyte
180	Thoracic Vert	Shape Alteration	Unknown	Bowing

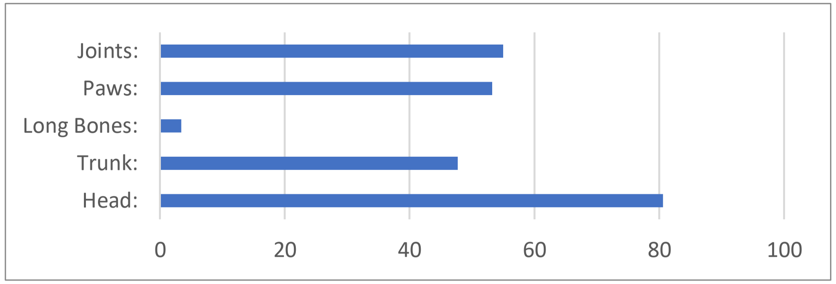
Key Dental:

Age at Death: Young Adult

After Death:

Context Type:	Cess Pit	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	83	**No Teeth:**	34

Completeness:



Summary:

Dog of unknown size and shape that lived during the Late Roman period. One of its ribs were fractured, and nearly healed when the animal died. The lesions on the vertebrae may have been caused by the same event as the fracture.

Summary:

Died as a young adult. Deposited in the same cess pit as OW-2, OW-3 and OW-19, although it is unknown if they were deposited at the same or at different times. Most bones survive well, except for the long bones.

ID OW-19

During Life:

Sex: Unknown
Withers (cm): Unknown
Shape: Unknown

Location: Owslebury
Phase: 4th AD
Region: South
Site Type: Rural

Pathology: Absent
No Lesions: 0

(ID) Key Lesions/Anomalies:

Key Dental:

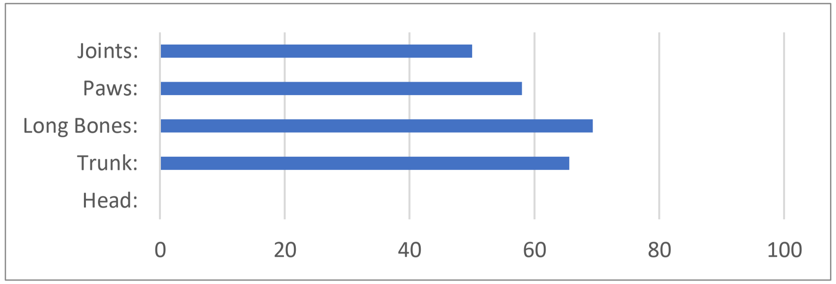
Age at Death: Immature

After Death:

Context Type: Cess Pit
Preservation: Good
Butchery: Absent
Gnawing: Present

No. Bones (Ex. Ribs): 88
No Teeth: 2

Completeness:



Summary:

Little known about the dog's life, except that it lived sometime in the Late Roman period. No pathology or lesions present.

Summary:

Died when young: most bones unfused. Deposited in the same cess pit as OW-2, OW-3 and OW-19, although it is unknown if they were deposited at the same or at different times. Perhaps the latter as the dog was gnawed by scavengers and the others were not.

ID OW-20

During Life:

Sex:	Male	**Withers (cm):**	32.7
		Shape:	Robust
Location:	Owslebury	**Region:**	South
Phase:	1st AD	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	20

(ID) Key Lesions/Anomalies:

181	Humerus	Bone Formation	Disease	Enthesophyte
182	Scapula	Bone Formation	Disease	Extension of Bone Ridge
183	Pelvis	Bone Formation	Disease	Enthesophyte
188	Rib	Bone Formation	Disease	Osteophyte
190	Thoracic Vert	Bone Formation	Disease	Osteophyte
193	Humerus	Shape Alteration	Congenital	Bowing

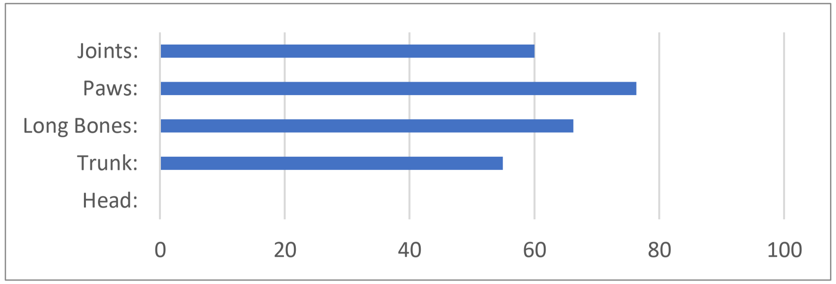
Key Dental:

Age at Death: Adult

After Death:

Context Type:	Gulley	**Butchery:**	Absent
Preservation:	Good	**Gnawing:**	Present
No. Bones (Ex. Ribs):	88	**No Teeth:**	0

Completeness:



Summary:

A very small, male dog that was affected by congenital dwarfism: the limbs were short and bowed. Lived during the start of the Roman occupation. Profuse bone growth throughout entire body: may have suffered from an infectious or inflammatory disease.

Summary:

The dog died sometime in adulthood, after which it was deposited in a gulley. Scavengers gnawed on the body, but despite this, the skeleton survived very well. The head is the only exception, being absent entirely.

ID OW-21

During Life:

Sex: Male
Withers (cm): 52.2
Shape: Slender

Location: Owslebury
Phase: 1st AD
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 0

(ID) Key Lesions/Anomalies:

44 **Key Dental:**	Maxilla	Alveolar Recession
45	M1	Significant Alveolar Recession, Abscess

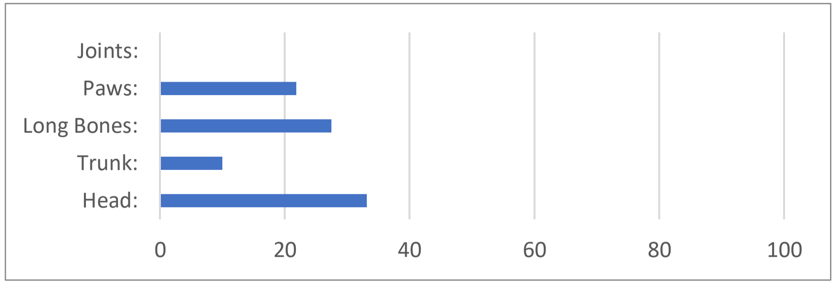
Age at Death: Adult

After Death:

Context Type: Gulley
Preservation: Poor
Butchery: Absent
Gnawing: Present

No. Bones (Ex. Ribs): 16
No Teeth: 6

Completeness:



Summary:

A large and slender male dog, it lived in the beginning of the Roman occupation. Suffered from peridontal disease and an abscess in the first molar. A small cloaca had formed in the bone for drainage, although it is unknown how well it healed overall.

Summary:

Found in the same context as OW-20. Possibly from same deposition event, but unlikely as preservation is significantly poorer. Most bones were lost, particularly small joints. The bones had also been gnawed by scavengers.

ID SF-1

During Life:

Sex: Unknown
Withers (cm): 56.3
Shape: Medium

Location: Suddern Farm
Phase: LIA
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 3

(ID) Key Lesions/Anomalies:

34	Rib	Fracture	Trauma	Transverse
35	Tarsal IV	Bone Formation	Trauma	Enthesophyte
36	Tarsal III	Bone Formation	Trauma	Enthesophyte

Key Dental:

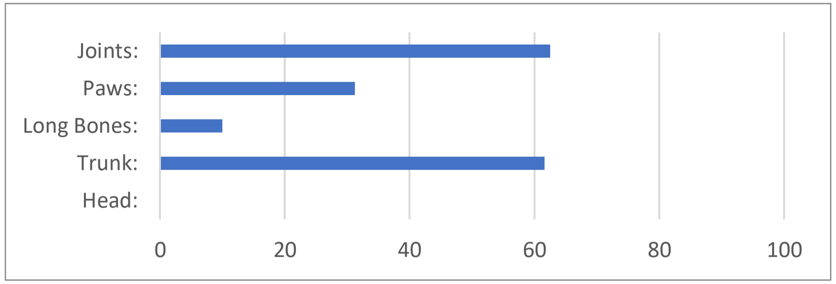
Age at Death: Adult

After Death:

Context Type: Pit
Preservation: Average
Butchery: Absent
Gnawing: Absent

No. Bones (Ex. Ribs): 104
No Teeth: 10

Completeness:



Summary:

A large dog of medium build, it lived during the Late Iron Age. It suffered from traumatic injury in at least two places: one ankle had huge bone growth, and a rib was fractured but healed. Whether these happened in the same event is unknown.

Summary:

The skeleton was deposited in a pit, and survived generally well. Interestingly, most of the bones that survived were small trunk, paw and joint bones. The dog was an adult of unknown age when it died.

ID SF-2

During Life:

Sex: Male
Withers (cm): 56.2
Shape: Medium

Location: Suddern Farm
Phase: Early 1st AD
Region: South
Site Type: Rural

Pathology: Present
No Lesions: 4

(ID) Key Lesions/Anomalies:

37	Calcaneum	Bone Formation	Arthropathy	Enthesophyte
38	Metatarsal	Bone Formation	Arthropathy	Enthesophyte
39	Metatarsal	Bone Formation	Arthropathy	Osteophyte
40	Metatarsal	Bone Formation	Arthropathy	Periostosis

Key Dental:

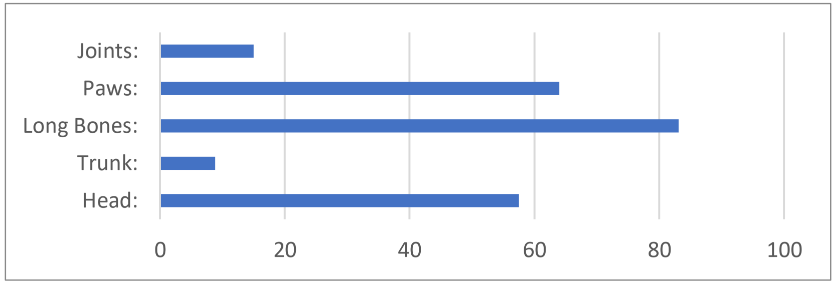
Age at Death: Older Adult

After Death:

Context Type: Pit
Butchery: Present
Preservation: Average
Gnawing: Absent

No. Bones (Ex. Ribs): 37
No Teeth: 18

Completeness:



Summary:

A large male dog of average build, it lived just before the Roman invasion. It was likely an older animal, as it had several lesions in the ankle and paws associated with age.

Summary:

Died sometime in later adulthood, likely when the dog was fairly elderly. The body was deposited in a pit, but was skinned beforehand. The skeleton survives fairly well, particularly the head and long bones.

ID SF-3

During Life:

Sex:	Male	**Withers (cm):**	49.9
		Shape:	Medium
Location:	Suddern Farm	**Region:**	South
Phase:	EIA	**Site Type:**	Rural
Pathology:	Present	**No Lesions:**	2

(ID) Key Lesions/Anomalies:

(ID)	Element	Lesion	Category	Type
42	Tibia	Fracture	Trauma	Oblique
43	Thoracic Vert	Bone Formation	Arthropathy	Osteophyte

Key Dental:

Summary:

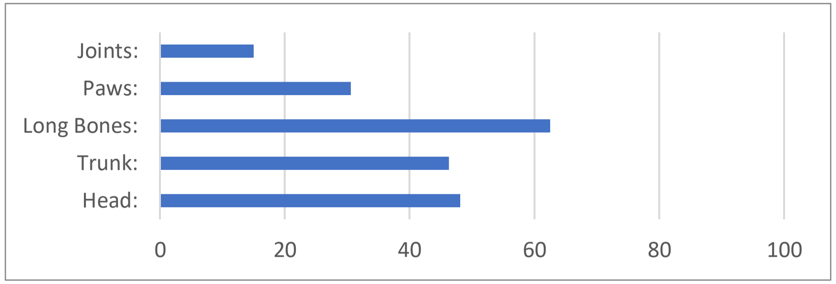
A fairly large male dog, it suffered a fracture to the back leg. This healed but at a slightly twisted angle, and the dog likely lived for a long time afterwards: it has another lesion associated with older age. Lived sometime in the Early Iron Age.

Age at Death: Older Adult

After Death:

Context Type:	Pit	**Butchery:**	Absent
Preservation:	Average	**Gnawing:**	Absent
No. Bones (Ex. Ribs):	39	**No Teeth:**	20

Completeness:



Summary:

Deposited in a pit after death, which was sometime in later adulthood. The skeleton survived fairly well, and both large and small bones were recovered. Many of the teeth were also found.

Appendix B: Statistical Analysis Tables and Supplementary Charts

Chapter 4: Kruskal-Wallis ANOVA, Post-Hoc Testing and Supplementary Charts

4.1. Dog Numbers Through Time

	$\chi 2$	df	p-value
NISP	26.92	10	0.0027
ABGs	9.99	10	0.44

Post-Hoc Testing

NISP	EIA	EIA/MIA	MIA	MIA/LIA	LIA	LIA/ER	ER	ER/MR	MR	MR/LR
EIA/MIA	0.670	-	-	-	-	-	-	-	-	-
MIA	0.994	0.449	-	-	-	-	-	-	-	-
MIA/LIA	0.890	0.922	0.811	-	-	-	-	-	-	-
LIA	0.438	0.950	0.219	0.870	-	-	-	-	-	-
LIA/ER	0.573	0.890	0.449	0.994	0.573	-	-	-	-	-
ER	0.449	0.994	0.219	0.890	0.890	0.754	-	-	-	-
ER/MR	0.449	0.994	0.233	0.890	0.950	0.870	0.994	-	-	-
MR	0.573	0.890	0.449	0.994	0.449	0.950	0.541	0.754	-	-
MR/LR	0.670	0.933	0.383	0.922	0.890	0.890	0.922	0.922	0.890	-
LR	0.890	0.449	0.890	0.811	0.010	0.219	0.005	0.219	0.219	0.233

4.2.1. Broad Settlement Type and NISP

	χ^2	df	p-value
Overall	22.14	4	0.00019
EIA	0.0032	1	0.96
MIA	3.05	1	0.081
LIA	1.85	3	0.61
ER	4.48	4	0.35
MR	7.34	3	0.062
LR	3.24	3	0.36

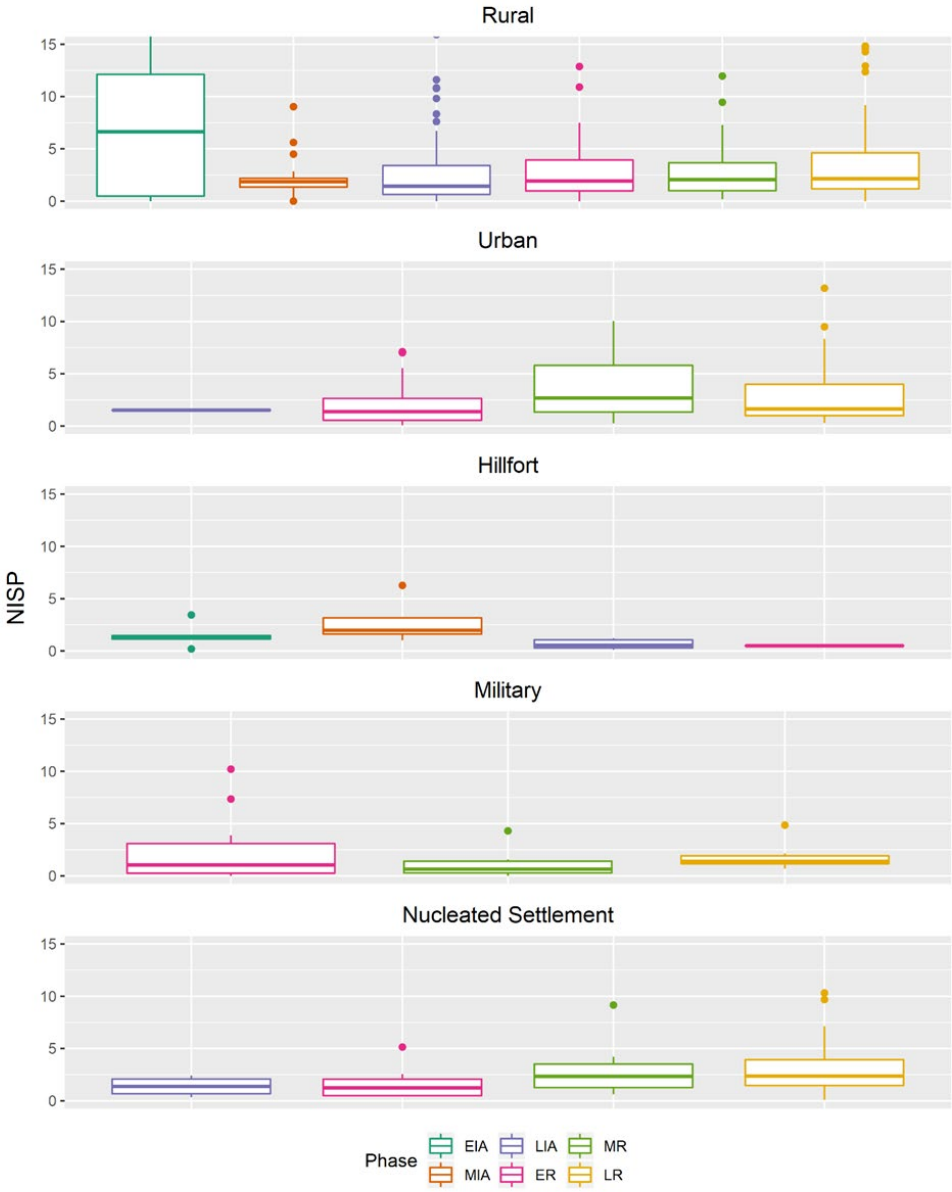
	χ^2	df	p-value
Overall	22.14	4	0.00019
EIA	0.0032	1	0.96
MIA	3.05	1	0.081
LIA	1.85	3	0.61
ER	4.48	4	0.35
MR	7.34	3	0.062
LR	3.24	3	0.36

Post-Hoc Testing

Middle Roman	Military	Nucleated Settlement	Rural
Nucleated Settlement	0.16	-	-
Rural	0.19	0.19	-
Urban	0.16	0.92	0.16

Military	ER	MR
MR	0.723	-
LR	0.076	0.104

4.2.1 Supplementary Chart



Boxplots of the five main settlement types by %NISP, divided by phase.

4.2.2. Broad Settlement Type and ABGs

	χ2	df	p-value
Overall	10.29	4	0.036
EIA	2.95	1	0.086
MIA	0.051	1	0.82
LIA	0.12	1	0.73
ER	6.58	3	0.087
MR	1.75	2	0.42
LR	7.12	3	0.068

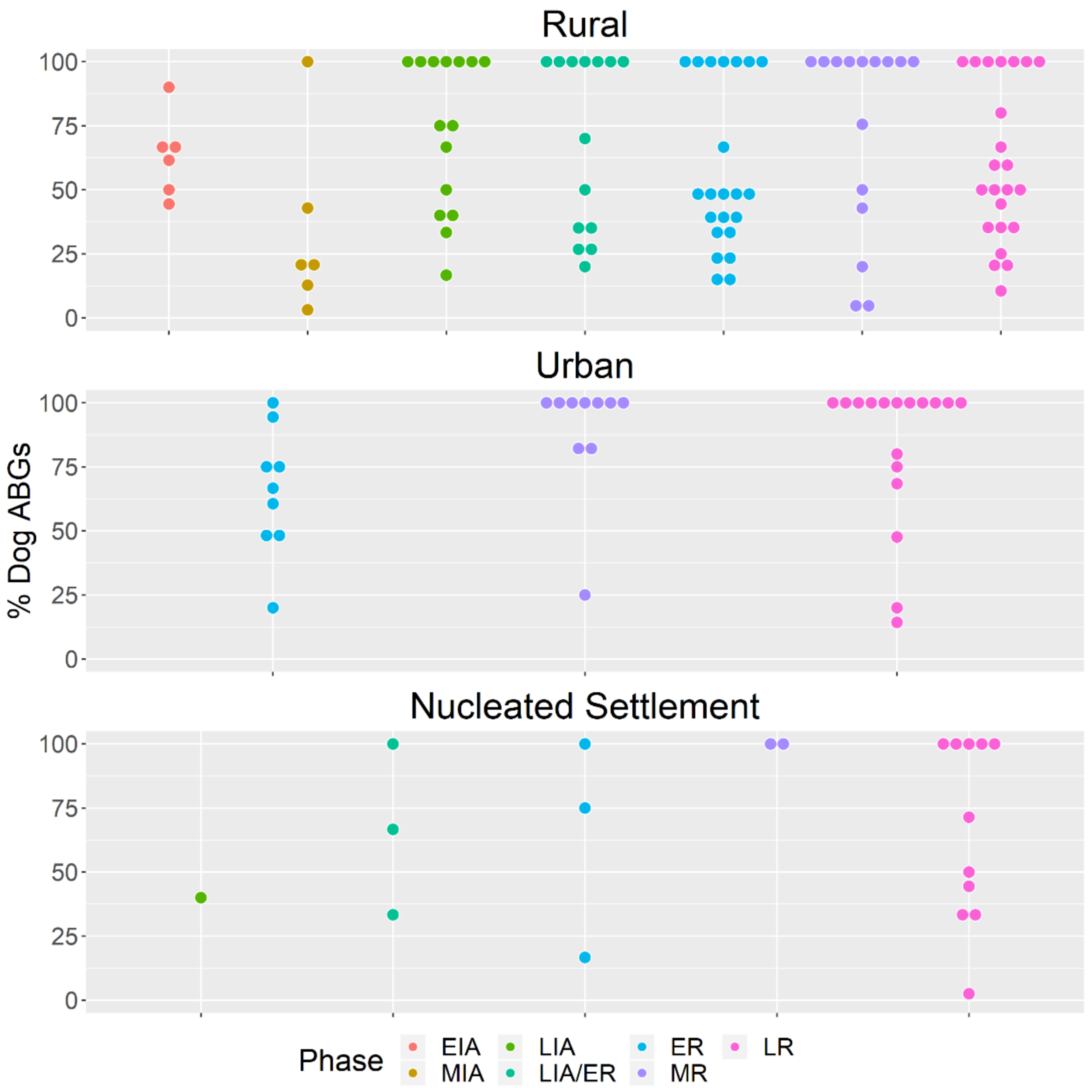
	χ2	df	p-value
Overall	10.29	4	0.036
Rural	13.59	5	0.019
Urban	3.07	2	0.22
Military	0.95	1	0.33
Hillfort	2	1	0.15
Nucleated	1.62	3	0.66

Post-Hoc Testing

Rural	EIA	MIA	LIA	ER	MR
MIA	0.25	-	-	-	-
LIA	0.12	0.25	-	-	-
ER	0.12	0.25	0.83	-	-
MR	0.12	0.25	0.55	0.55	-
LR	0.21	0.94	0.18	0.12	0.12

Late Roman	Military	Nucleated Settlement	Rural
Nucleated Settlement	0.34	-	-
Rural	0.15	0.15	-
Urban	0.15	0.22	0.82

4.2.2 Supplementary Chart



Dotplot of dog %ABG (as proportion of all ABGs) per site phase, divided by phase.

4.2.3. Settlement Size, Villas and NISP

Settlement Size

	χ2	df	p-value
Overall	13.98	2	0.00092
LIA	1.21	2	0.55
ER	3.56	2	0.17
MR	5.62	2	0.06
LR	2.47	2	0.29

	χ2	df	p-value
Overall	13.98	2	0.00092
Small	6.25	3	0.1
Medium	5.16	3	0.16
Large	2.55	3	0.47

Post-Hoc Testing

Middle Roman	large (9+ ha)	medium (4 - 8 ha)
medium (4 - 8 ha)	0.2	-
small (<1 - 3 ha)	0.11	0.2

Small	LIA	ER	MR
ER	0.7	-	-
MR	0.37	0.37	-
LR	0.14	0.14	0.53

Villas

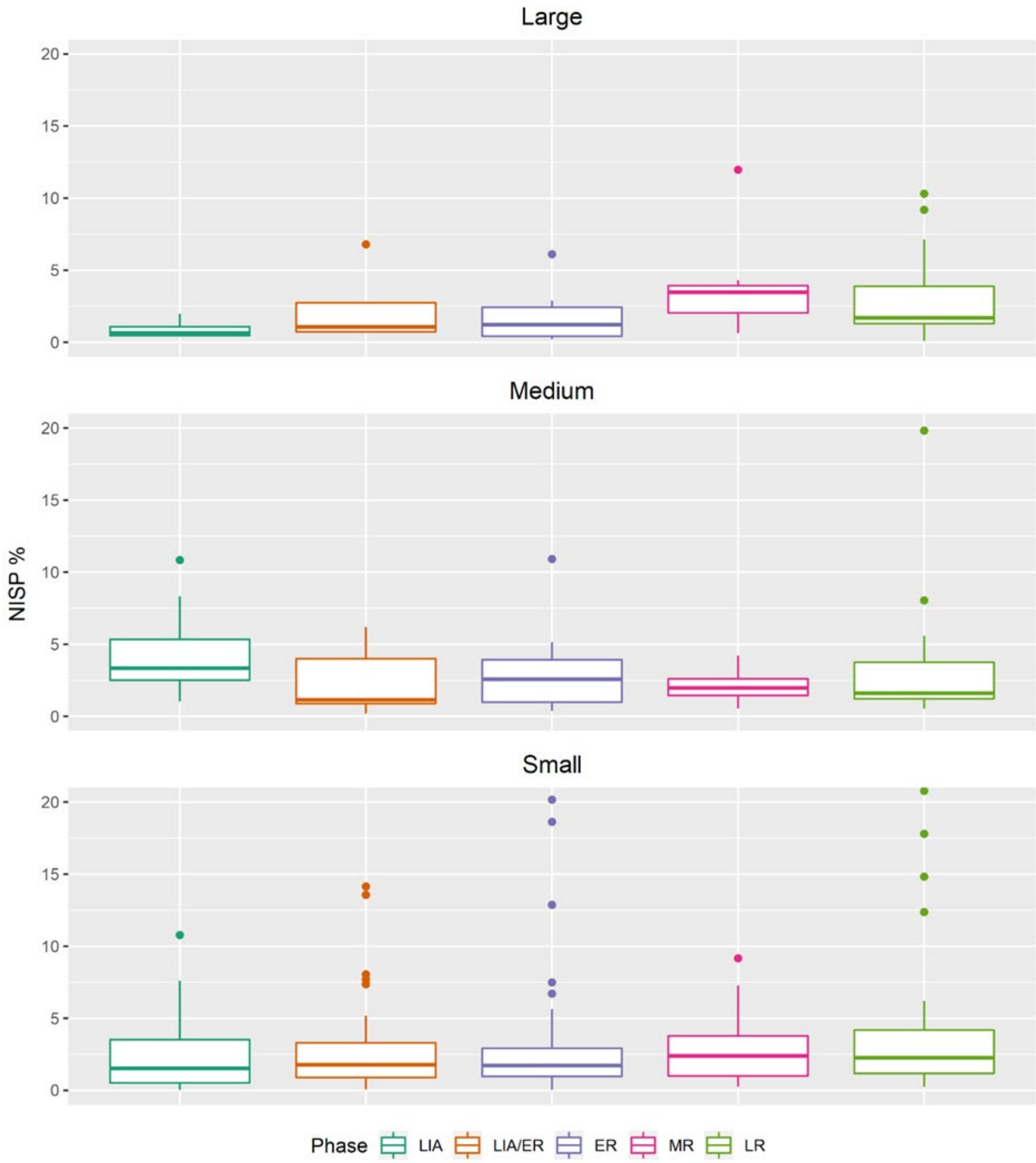
	χ2	df	p-value
Overall	2.86	1	0.091
LIA	1.74	1	0.19
ER	1.31	1	0.25
MR	1.67	1	0.2
LR	1.24	1	0.27

	χ2	df	p-value
Overall	2.86	1	0.091
Villa Buildings	1.55	3	0.67
No Villa Buildings	9.25	3	0.026

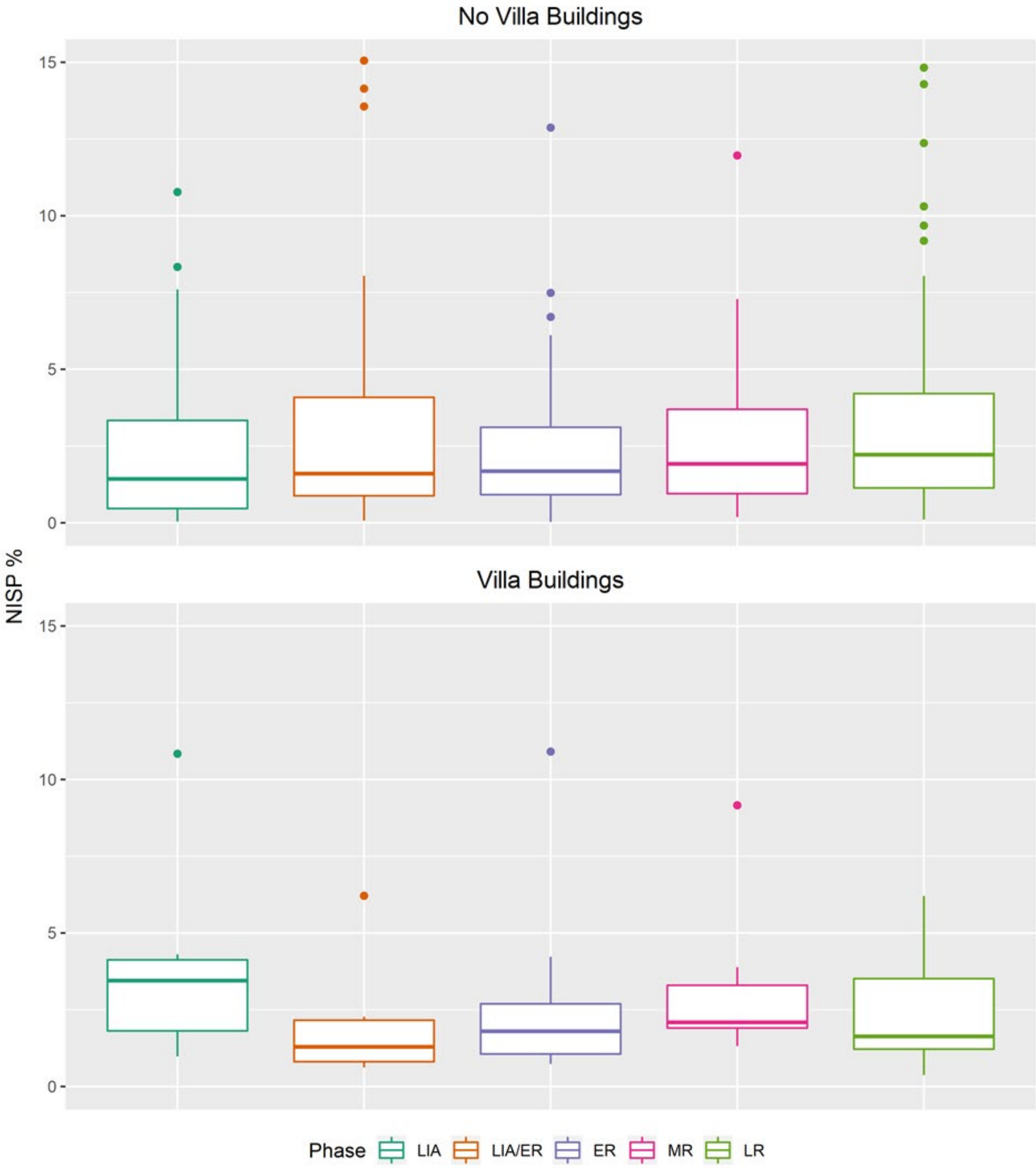
Post-Hoc Testing

No Villa Buildings	LIA	ER	MR
ER	0.38	-	-
MR	0.128	0.351	-
LR	0.064	0.075	0.351

4.2.3 Supplementary Charts



Boxplots of dog %NISP by phase and settlement size.



Boxplots of dog %NISP by phase and presence of villa buildings.

4.2.4. Settlement Size, Villas and ABGs

	χ2	df	p-value
Overall	3.01	2	0.22
LIA	1.78	2	0.41
ER	0.77	2	0.68
MR	4.45	2	0.11
LR	2.85	2	0.24

	χ2	df	p-value
Overall	3.01	2	0.22
Small	3.52	3	0.32
Medium	2.94	3	0.4
Large	2.87	3	0.41

Chapter 5: Kruskal-Wallis ANOVA, Post-Hoc Testing and Supplementary Charts

5.1.1. NISP by Region and 5.1.3. ABGs by Region

	$\chi 2$	df	p-value
NISP	24.06	6	0.00051
ABGs	48.3	6	1.03E-08

Post-Hoc Testing

NISP

	Central Belt	Central West	East	North	North East	South
Central West	0.962	-	-	-	-	-
East	0.962	0.962	-	-	-	-
North	0.052	0.171	0.072	-	-	-
North East	0.162	0.403	0.281	0.017	-	-
South	0.007	0.281	0.129	0.007	0.962	-
South West	0.777	0.702	0.846	0.171	0.962	0.962

ABGs

	Central Belt	Central West	East	North	North East	South
Central West	0.493	-	-	-	-	-
East	0.316	0.339	-	-	-	-
North	0.339	0.736	0.316	-	-	-
North East	1.000	0.487	0.339	0.339	-	-
South	1.50E-07	0.057	0.035	0.075	0.001	-
South West	0.555	1.000	0.493	-	0.555	0.339

5.2.1. NISP by Phase and Region

	χ2	df	p-value
Overall	26.81	12	0.008
South	25.02	12	0.015
North East	7.14	6	0.31
East	14.17	11	0.2235
Central Belt	21.09	12	0.049

Post-Hoc Testing

	EIA	EIA/MIA	ER	ER/MR	IA	LIA	LIA/ER	LR	MIA	MIA/LIA	MR	MR/LR
EIA/MIA	0.6	-	-	-	-	-	-	-	-	-	-	-
ER	0.488	0.667	-	-	-	-	-	-	-	-	-	-
ER/MR	0.309	0.916	0.563	-	-	-	-	-	-	-	-	-
IA	0.956	0.573	0.563	0.331	-	-	-	-	-	-	-	-
LIA	0.621	0.563	0.569	0.306	0.725	-	-	-	-	-	-	-
LIA/ER	0.563	0.569	0.621	0.306	0.621	0.956	-	-	-	-	-	-
LR	0.637	0.41	0.18	0.156	0.91	0.725	0.621	-	-	-	-	-
MIA	0.707	0.156	0.031	0.031	0.601	0.115	0.046	0.156	-	-	-	-
MIA/LIA	0.916	0.773	0.916	0.661	0.773	0.916	0.916	0.796	0.424	-	-	-
MR	0.725	0.306	0.156	0.115	0.97	0.621	0.569	0.901	0.156	0.667	-	-
MR/LR	0.661	0.54	0.489	0.193	0.838	0.916	0.725	0.956	0.115	0.901	0.796	-
R	0.563	0.773	0.916	0.621	0.621	0.731	0.773	0.621	0.078	1	0.563	0.655

5.2.1 Supplementary Chart

Region	LIA	LIA/ER	ER	MR	LR
Central Belt	32	29	44	52	72
East	11	3	18	7	20
North East	4	8	9	12	20
South	28	29	62	26	50

Number of site phases with at least one dog bone, per region and phase.

5.2.2. ABGs by Phase and Region

	χ^2	df	p-value
Overall	10.73	12	0.55
South	14.89	12	0.25
North East	6.54	5	0.26
East	3.85	5	0.57
Central Belt	9.52	11	0.57

5.3.1. Settlement Types and NISP

	χ2	df	p-value
Overall	22.14	4	0.00019
South	18.68	3	0.00032
North East	11.54	3	0.0092
East	10.11	4	0.039
Central Belt	8.34	4	0.08

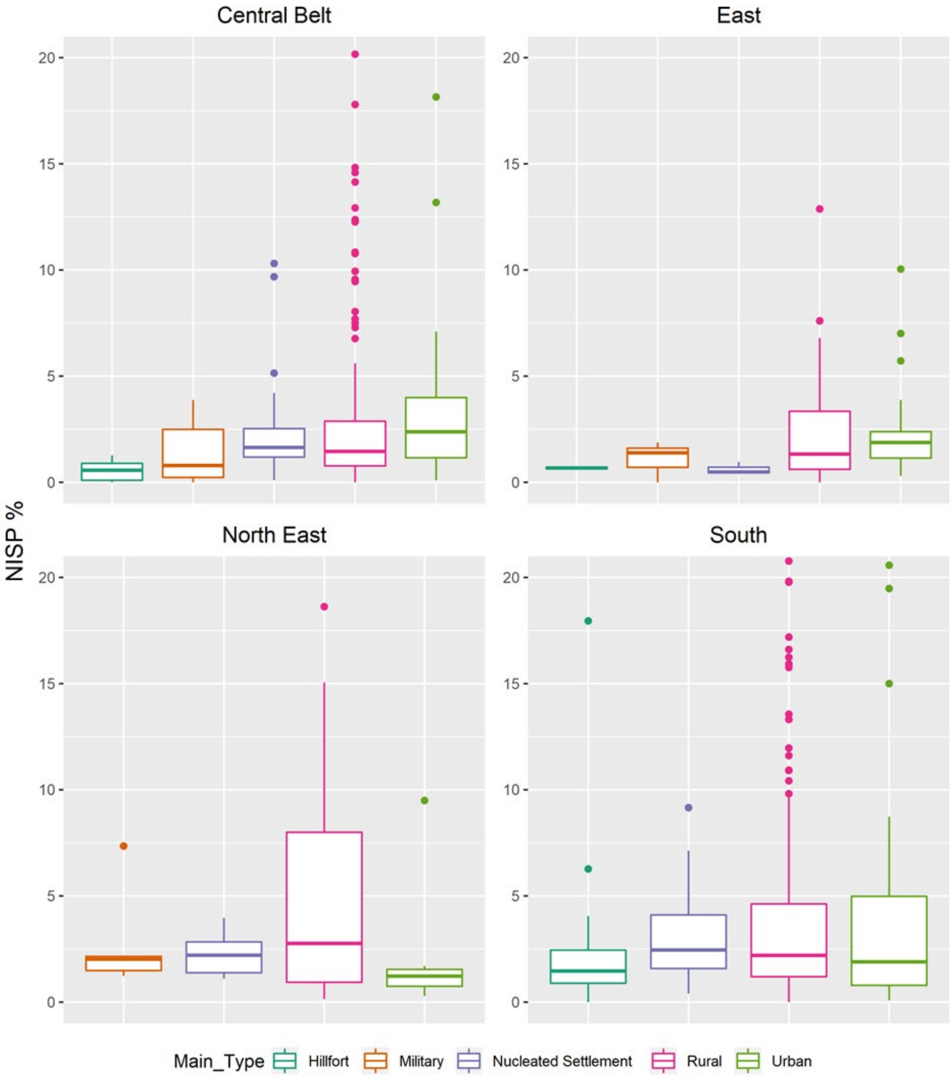
Post-Hoc Testing

North East	Military	Nucleated Settlement	Rural
Nucleated Settlement	0.379	-	-
Rural	0.094	0.037	-
Urban	0.091	0.014	0.678

East	Hillfort	Military	Nucleated Settlement	Rural
Military	0.868	-	-	-
Nucleated Settlement	0.506	0.544	-	-
Rural	0.544	1	0.506	-
Urban	1	0.463	0.058	0.058

South	Hillfort	Nucleated Settlement	Rural
Nucleated Settlement	0.3521	-	-
Rural	0.0512	0.0771	-
Urban	0.3975	0.6452	0.0021

5.3.1. Supplementary Chart



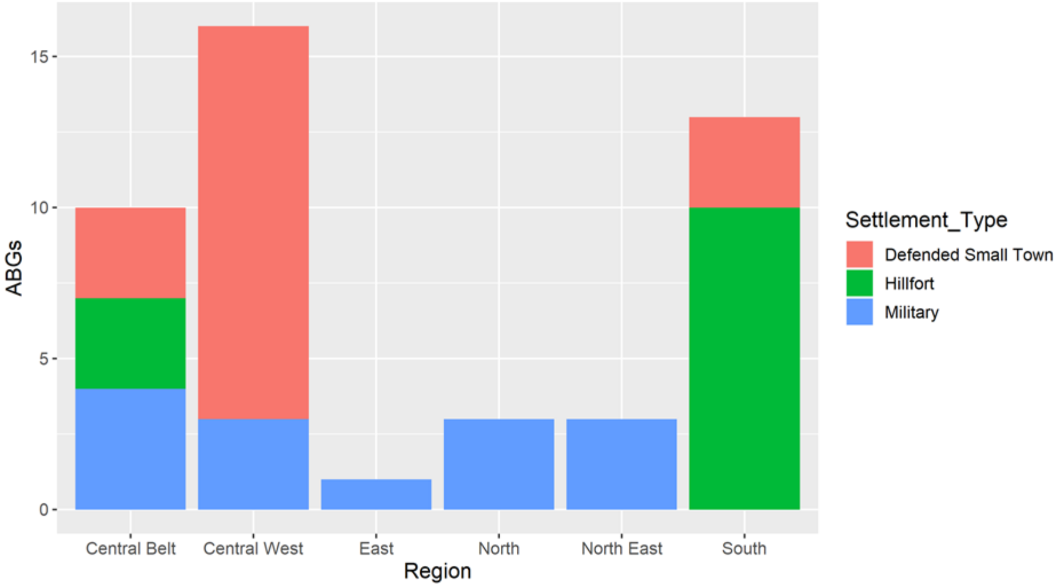
Boxplots of dog %NISP numbers by region and settlement type.

5.3.2. Settlement Types and ABGs

	$\chi 2$	df	p-value
Overall	10.29	4	0.035
South	2.68	3	0.44
North East	0.27	3	0.99
East	5.85	3	0.12
Central Belt	5.27	4	0.26

5.3.3. Smaller Sites in Detail

Supplementary Chart



Dog ABG counts by smaller settlement type in all regions. No results for South West.

5.3.4. Other Settlement Features

Settlement Form

	χ2	df	p-value
Overall	3.95	3	0.27

NISP

	χ2	df	p-value
Overall	13.98	2	9.20E-04
South	2.11	2	0.35
North East	0.91	2	0.64
East	2.31	2	0.32
Central Belt	11.64	2	0.003

Post-Hoc Testing

Central Belt	large (9+ ha)	medium (4 - 8 ha)
medium (4 - 8 ha)	0.2526	-
small (<1 - 3 ha)	1	0.0018

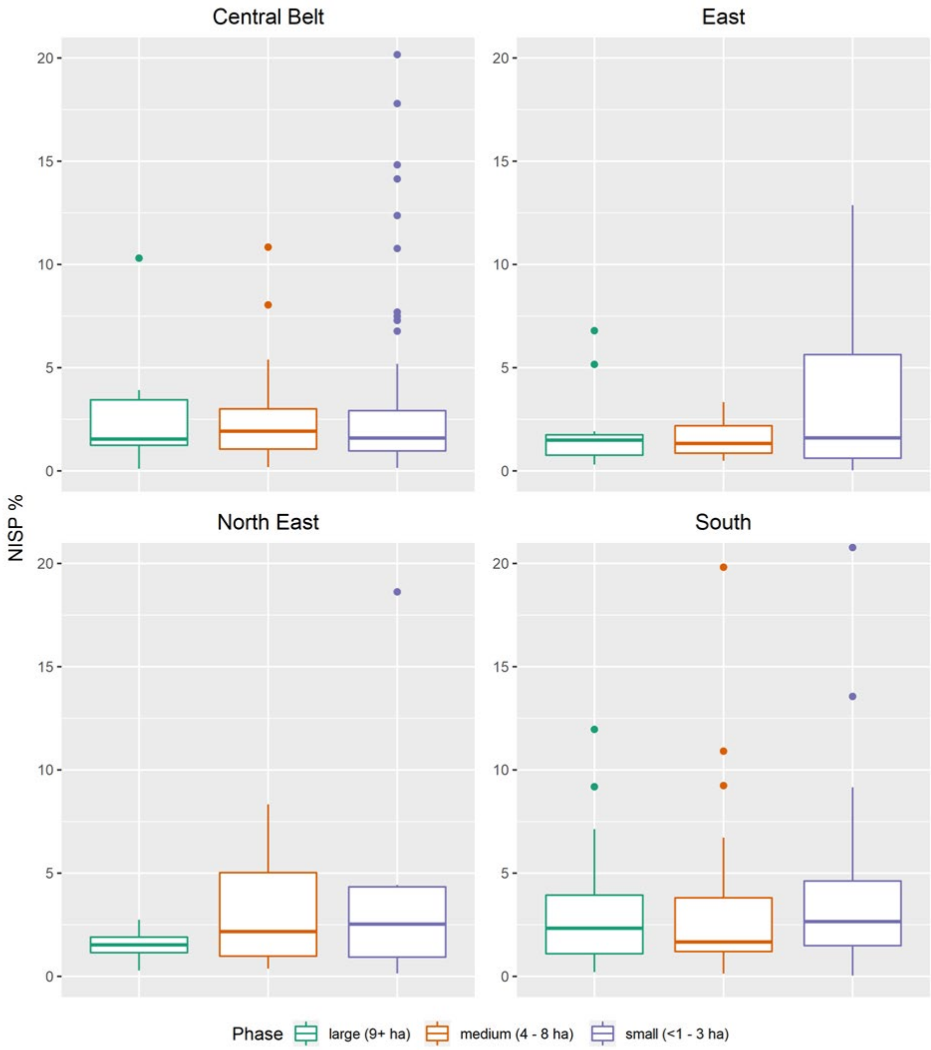
ABGs

	χ2	df	p-value
Overall	3.01	2	0.22
South	0.75	2	0.69
North East	1.88	2	0.39
East	4.23	2	0.12
Central Belt	5.1	2	0.078

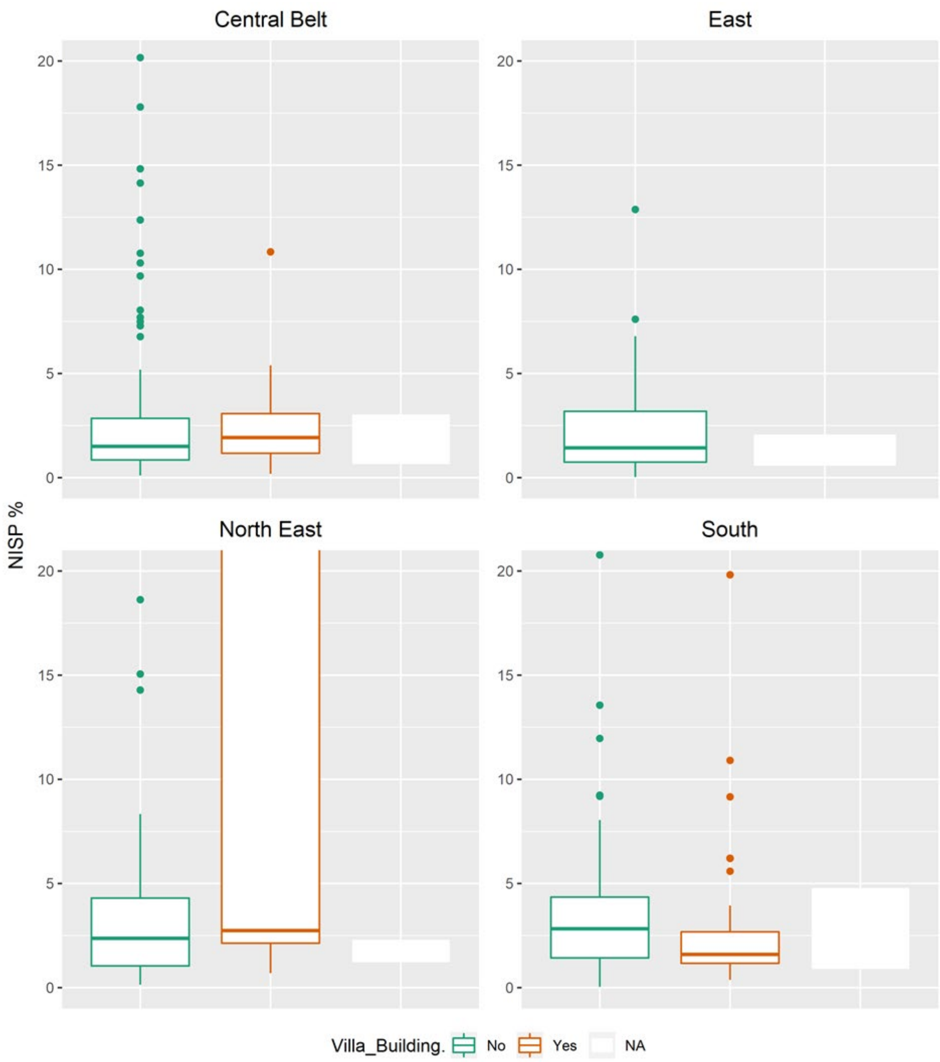
Post-Hoc Testing

Central Belt	large (9+ ha)	medium (4 - 8 ha)
medium (4 - 8 ha)	0.084	-
small (<1 - 3 ha)	0.176	0.176

5.3.4. Supplementary Charts



Boxplots of dog %NISP numbers by region and settlement size.



Boxplots of dog %NISP numbers by region and presence of villa buildings.

Chapter 7: Spearman's Rank Correlation Coefficient and Kendall Tau

7.2.1. Canine Roles in Agricultural Communities

	S	p-value	rho
Overall	5294700	2.20E-16	0.59
South	201370	9.23E-16	0.6
North East	19317	5.87E-06	0.54
East	8913.4	0.013	0.37
Central Belt	972180	2.20E-16	0.61

	S	p-value	rho
Overall	5294700	< 2.2E-16	0.59
LIA	9008.4	0.015	0.36
LIA/ER	13396	1.59E-05	0.54
ER	53229	3.35E-07	0.52
MR	23353	1.33E-11	0.68
LR	88204	< 2.2E-16	0.67

7.2.2. Romans, Dogs and Hunting

	Spearman's			Kendall		
	S	p-value	rho	z	p-value	tau
Overall	2653800	1.31E-13	0.41	4.96	7.02E-07	0.14
South	99390	8.19E-05	0.38	1.7	0.09	0.077
North East	1243.3	0.0021	0.58	2	0.046	0.21
East	2486.5	0.23	0.24	1.3	0.19	0.11
Central Belt	227280	6.06E-08	0.45	4.12	3.79E-05	0.18

	Spearman's			Kendall		
	S	p-value	rho	z	p-value	tau
Overall	3980000	0.046	0.12	4.96	7.02E-07	0.14
LIA	2950	0.0082	0.46	1.32	0.19	0.12
LIA/ER	7961.9	0.44	0.13	1.97	0.049	0.18
ER	15533	0.0022	0.41	2.37	0.018	0.15
MR	18022	0.048	0.27	3.22	1.30E-03	0.23
LR	58811	4.85E-09	0.56	3.98	7.03E-05	0.22

Appendix C: Select Pathology and Supplementary Photographs

Supplementary Photographs

Image 1: The range of ABG shapes, as shown by the humerus.

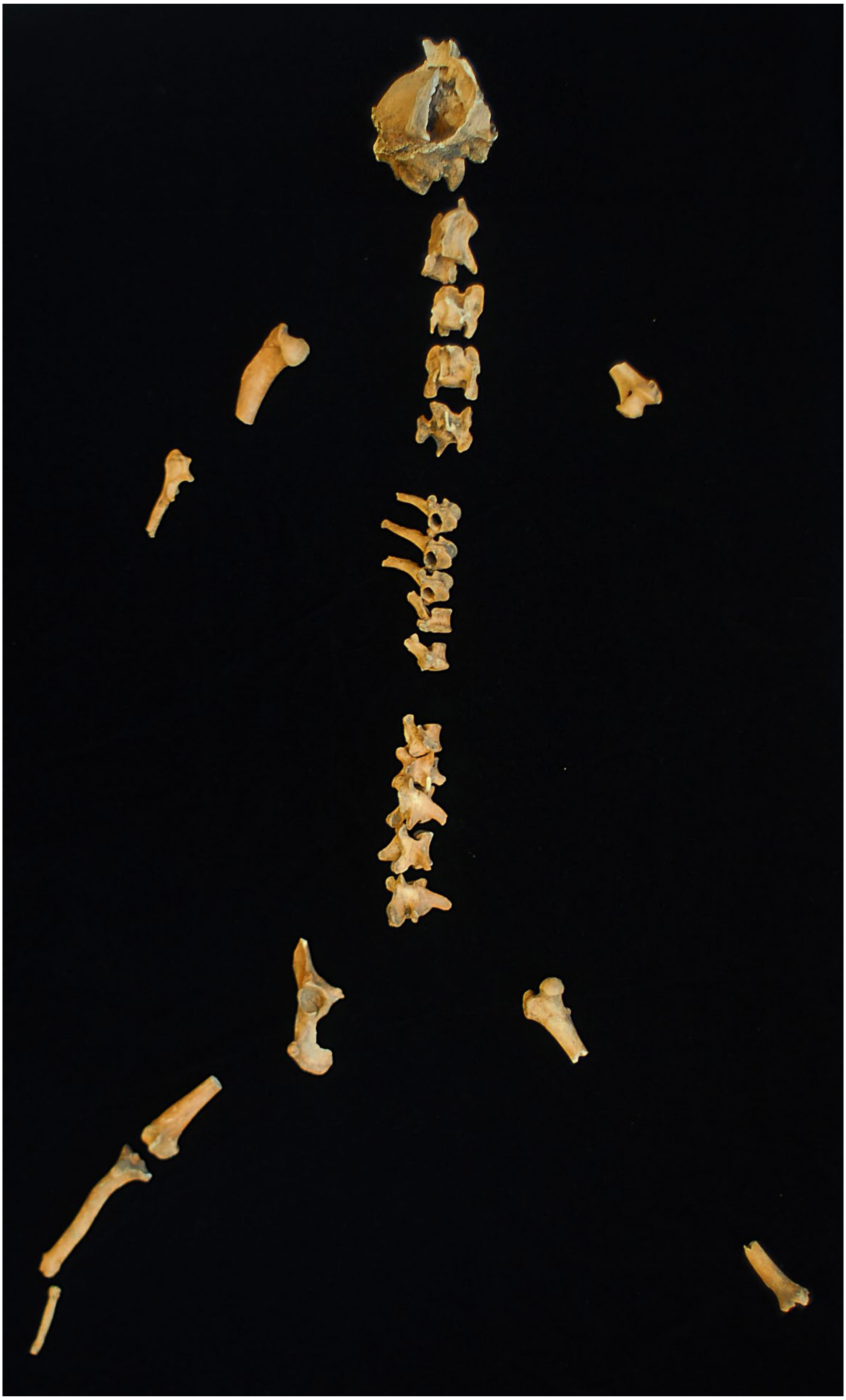


Image 2: The whole skeleton of CA-2. As seen, a number of bones are missing and the skull is badly damaged, but the unusual pathology (see Chapter 7 and next section) reveal an eventful life.

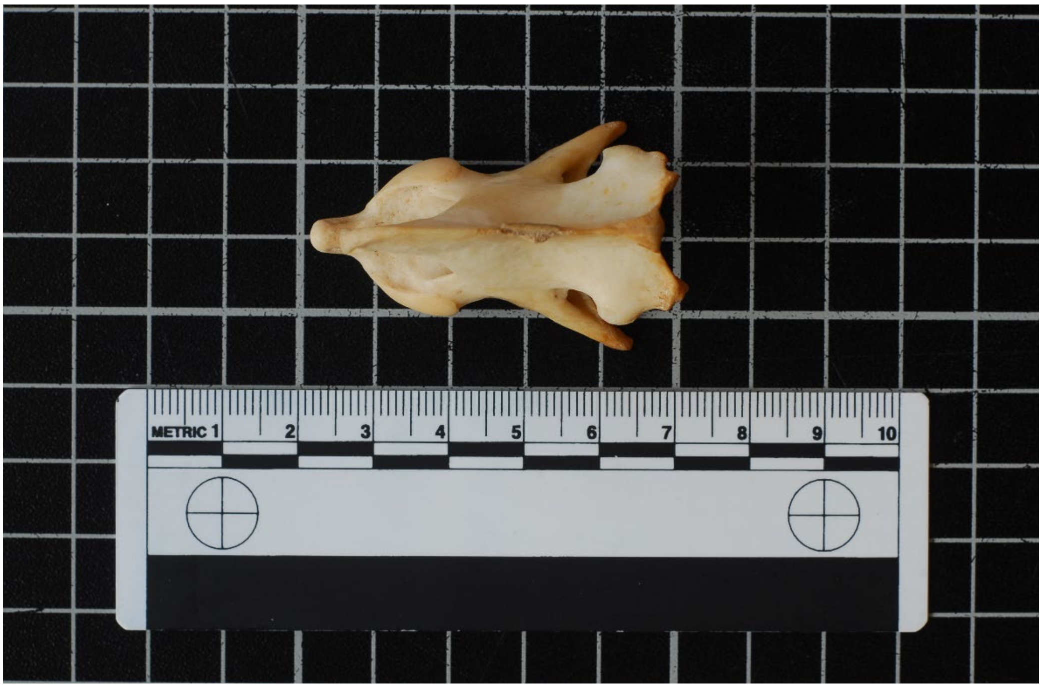
Image 3: A more complete skeleton, OW-1 is the best surviving of all the ABGs. Only a femur, several vertebrae and small paw bones are missing.

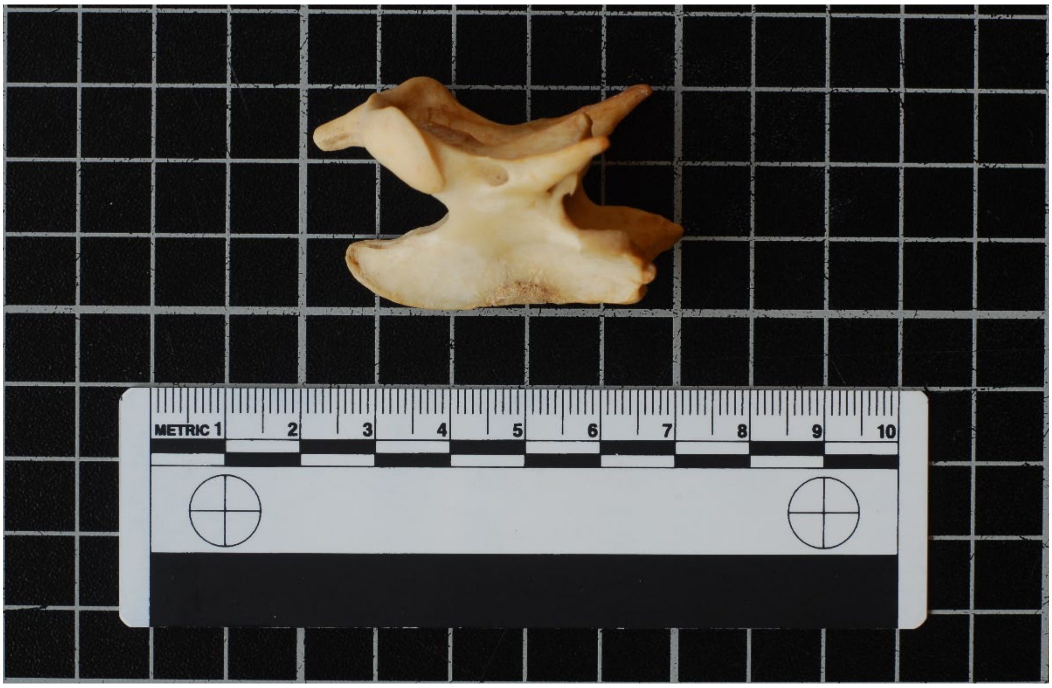
Select Pathology and Butchery

By Site and ABG ID (in Alphabetical Order)

Baldock

BAL 485-3



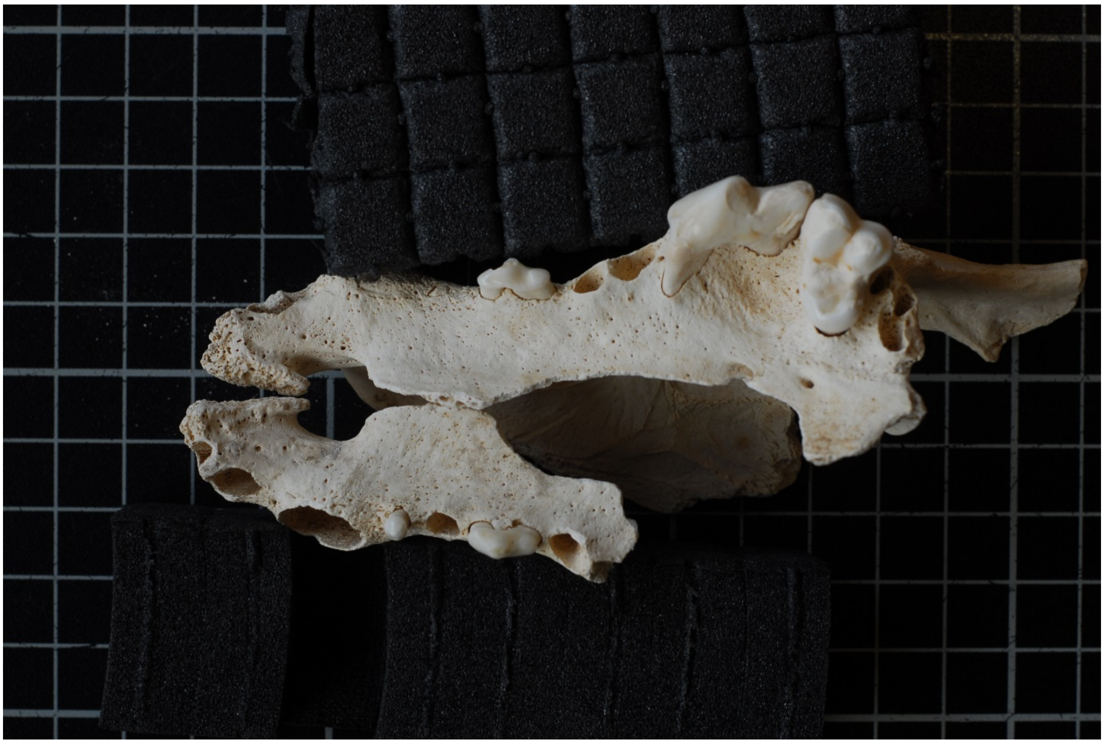


Lesion 55: broken spinous process, butterfly fracture, showing porosity and signs of healing - active at death.

BAL 485-4

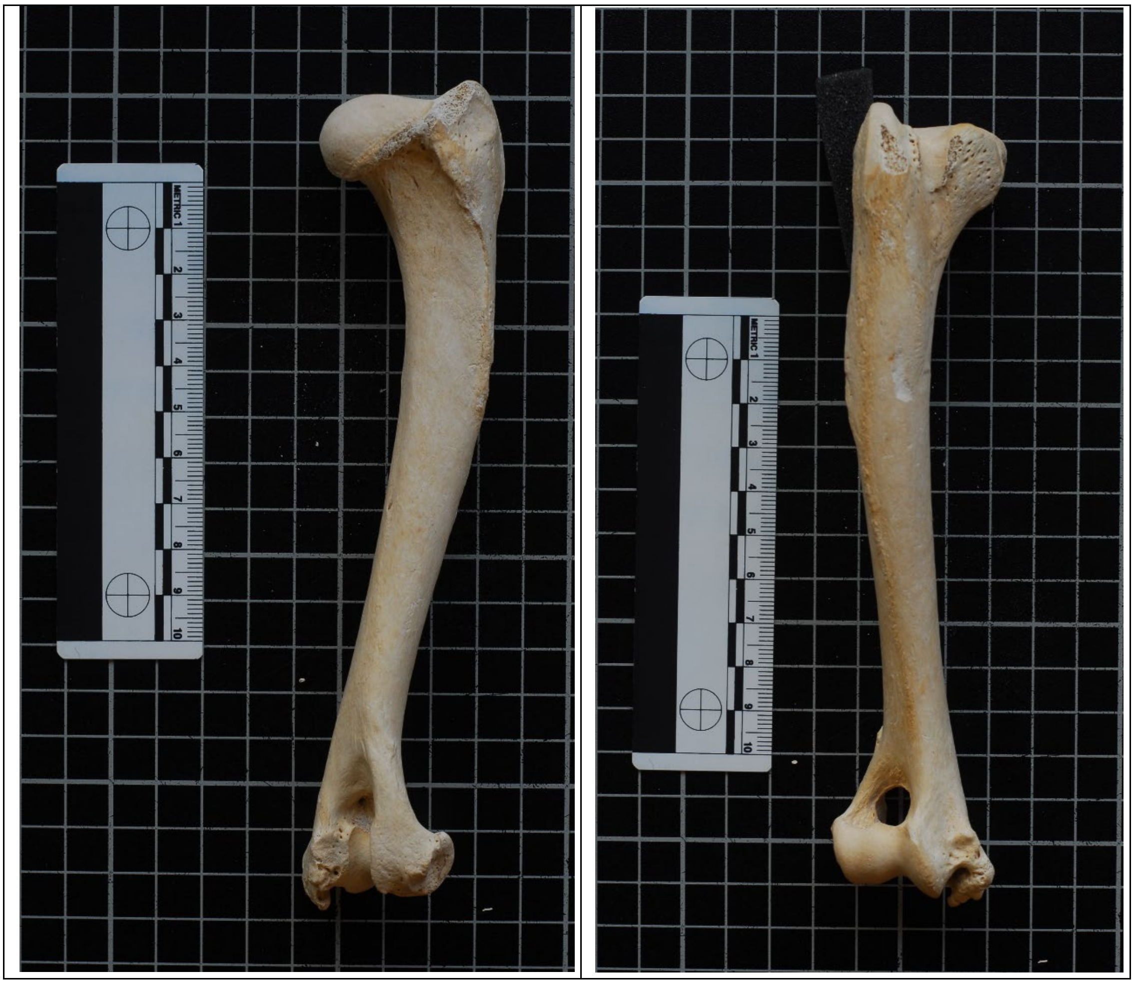
Lesion 60: eburnation at proximal end of articular surface.

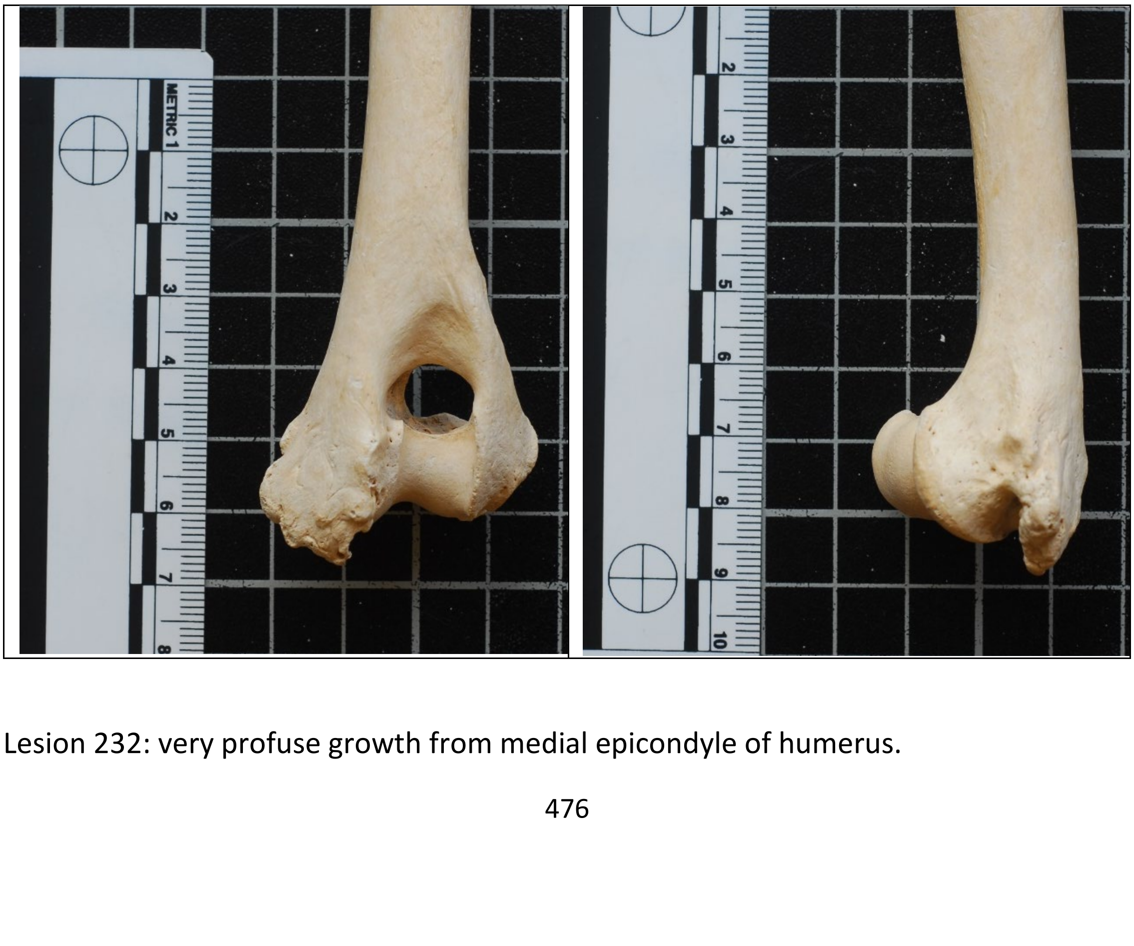
BAL-526



Tooth lesion 63: supernumerary tooth between uP1 and canine. Peg shaped, with few distinguishing features.

BAL-526 continued





Lesion 232: very profuse growth from medial epicondyle of humerus.

Balksbury Camp

BC-3

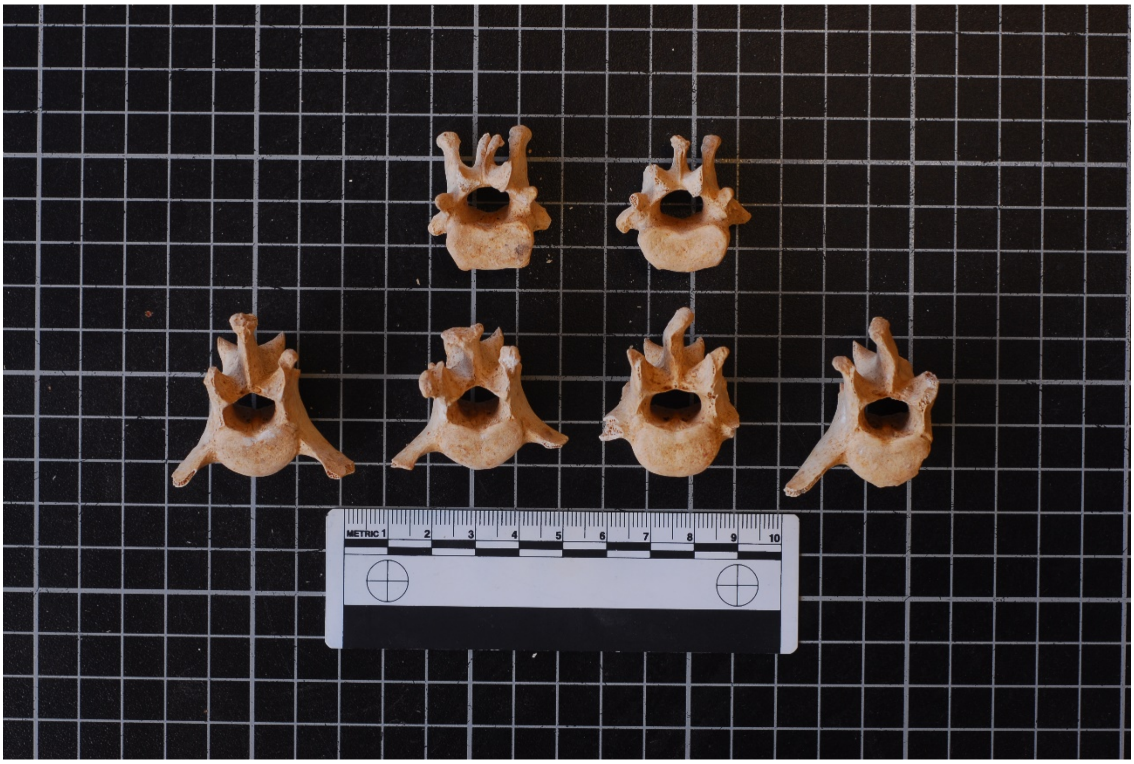
Tooth lesion 47: image of the mandible and close-up of the first molar, demonstrating probable hypoplasia of the enamel.

BC-4

BC-4 continued

Lesions 205-209, displaying destruction of the caudal surface of the vertebral bodies and profuse growth along the ventral side, spreading to the tubercule and head of the rib.

BC-6

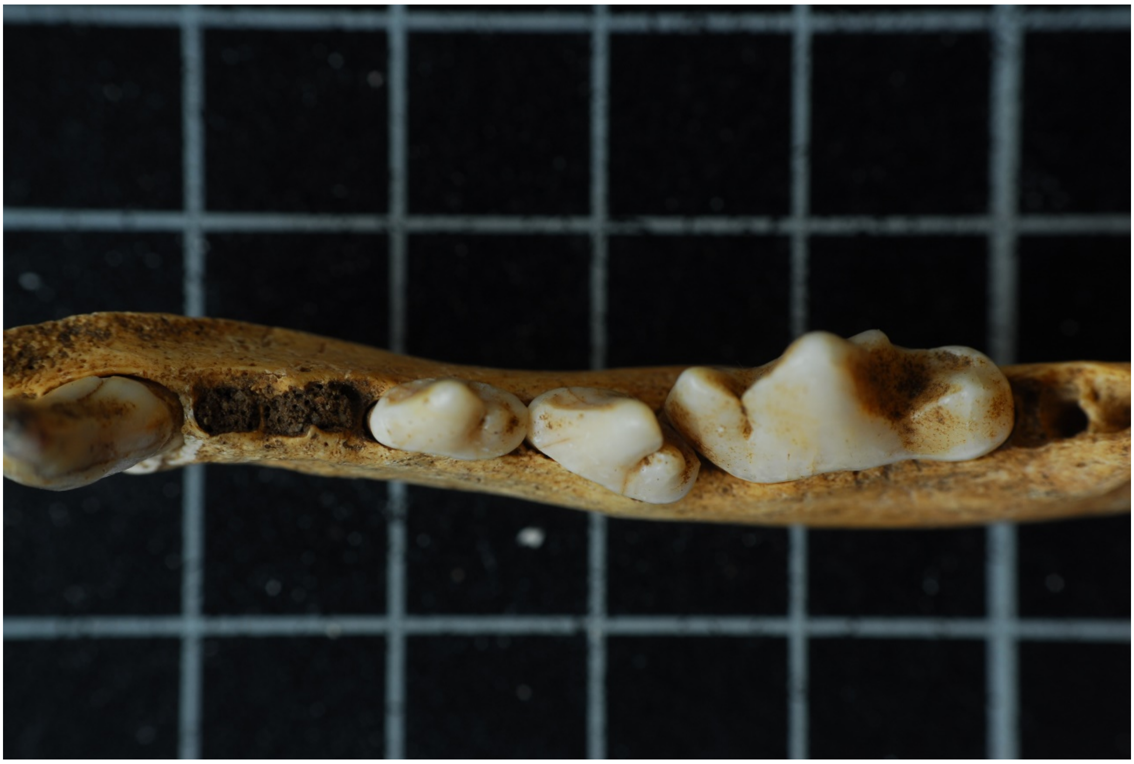


Lesions 212-215: lumbar vertebrae of BC-6. Several show signs of bowing in the spinous process to various degrees.

Caistor

CA-1

CA-1 continued

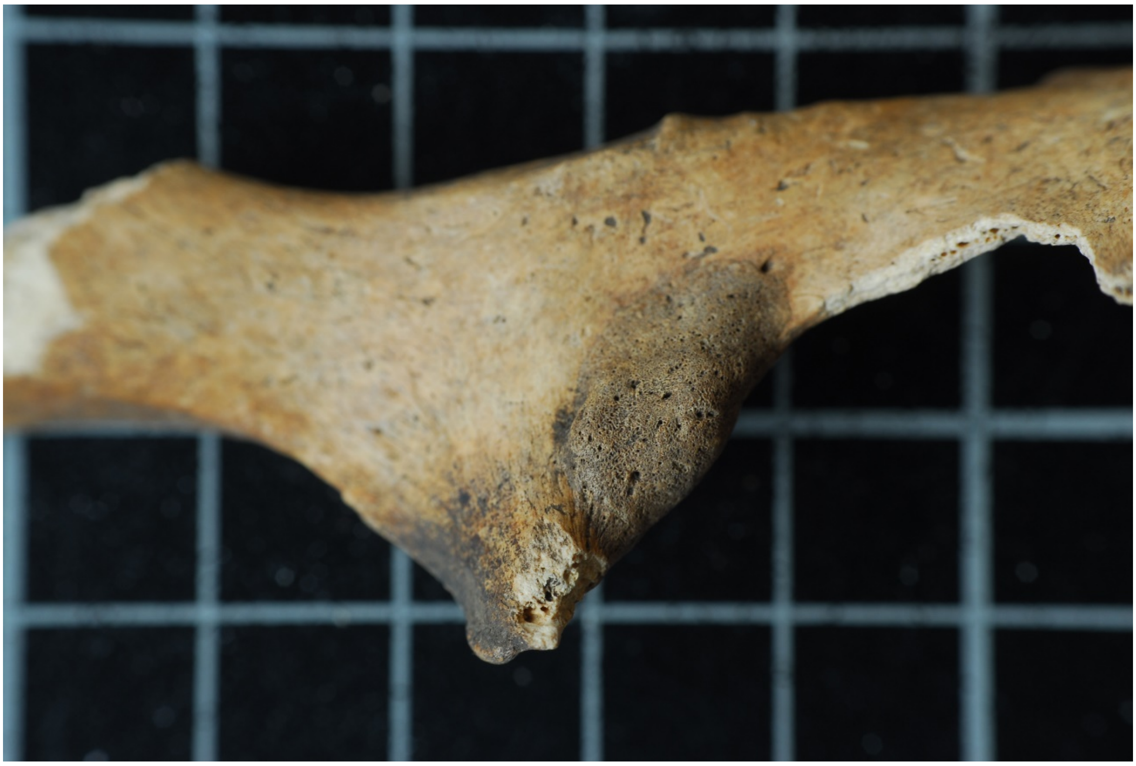


Tooth lesions 24-27: rotation of upper P3 and lower P4. Also congenital absence of third molar and missing upper P2.

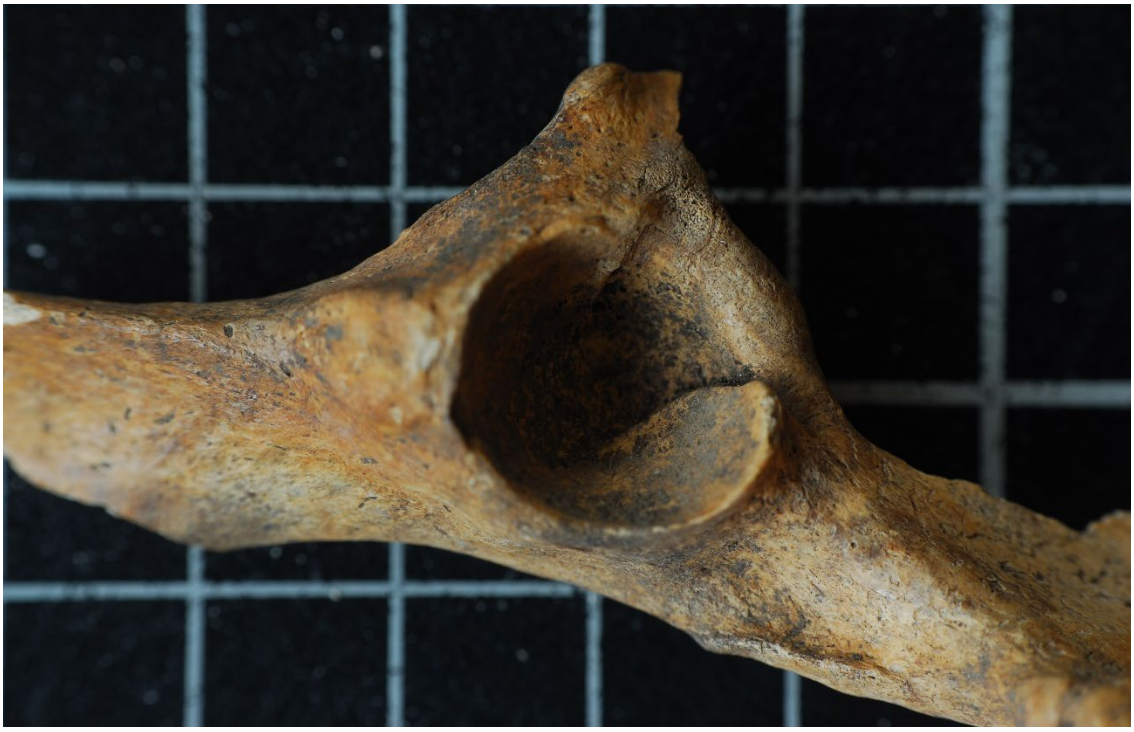
CA-2

Lesion 72: swelling in the distal metaphysis of the femur.

CA-2 continued



CA-2 continued



Lesion 71: large callus on caudal side of acetabulum. Possible healing of incomplete or oblique fracture.

Danebury

DA-9

Lesion 69: healed oblique fracture at distal end of femur shaft. Large amount of periostosis leading to a smaller appearance, and bowing/angulation of upper part of

shaft in a medial direction. Surface largely regular aside from irregular ridges at dorsal side.

DA-10

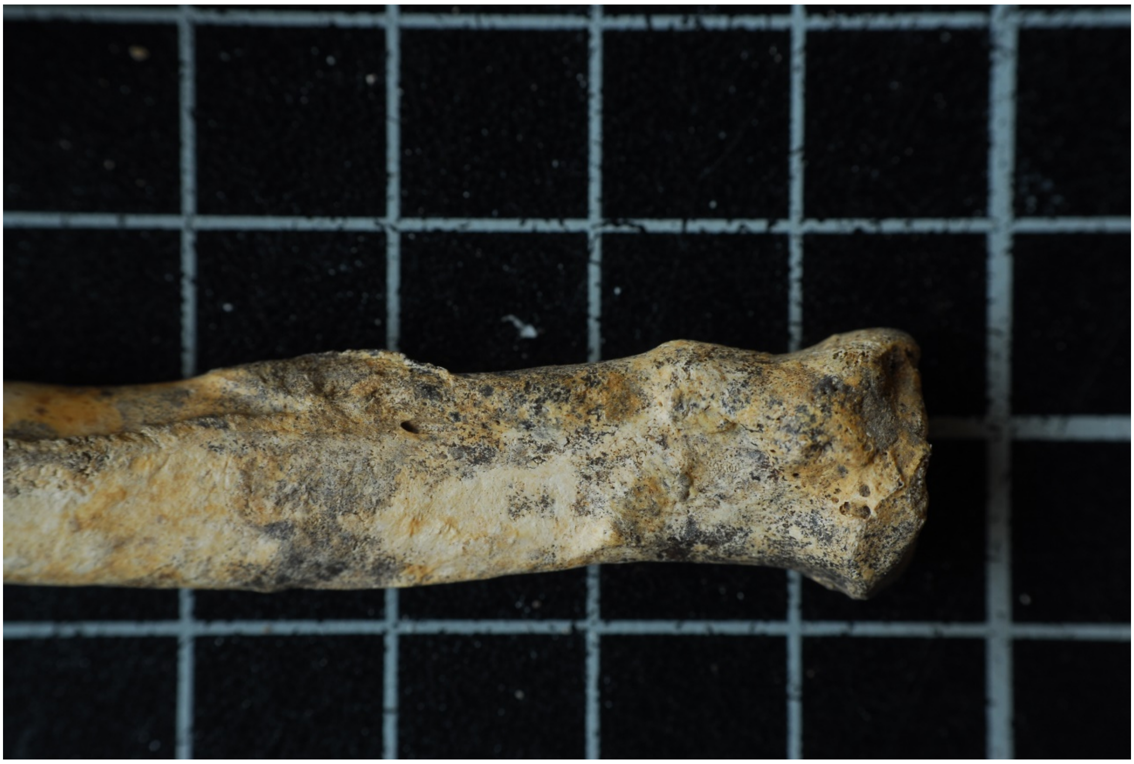
Dental lesion 21: ante-mortem loss of right canine, shown by some alvelous infilling and draining cloaca (5mm) on buccal side of mandible, underneath the tooth socket.

Fishbourne

FB-1

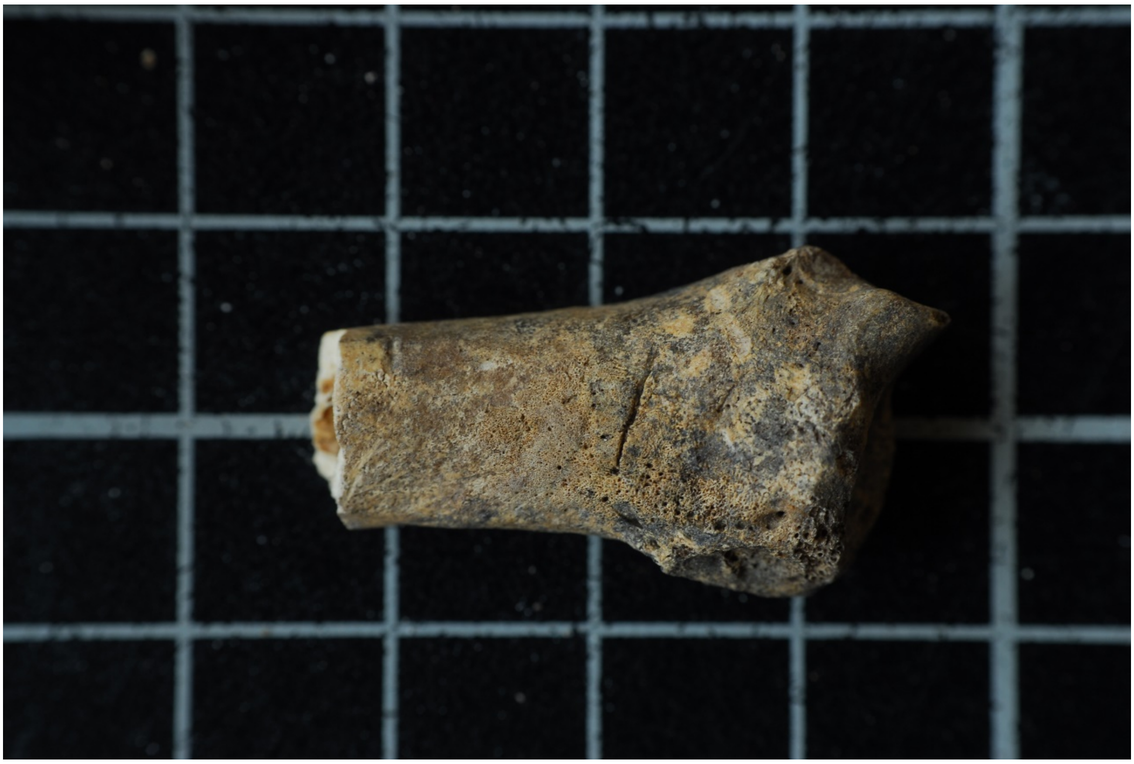
Lesions 80 and 83: osteophyte formation and small patch of eburnation on border of humeral head.

FB-1 continued



Lesions 78 and 79: profuse new periosteal formation on medial and caudal surfaces of distal ulna and Reactive periosteal formation of the distal end of the caudal surface. Partially remodelled.

FB-1 continued



Butchery mark 5: cut mark 90 degrees parallel to the length of bone.

Greyhound Yard

GY-7

Lesion 231: fracture halfway along the nasal bone - impact has broken bone in half, both across and down the middle. Impact drove the right nasal bone under the left nasal and adjoining maxilla. Shows signs of healing.

GY-7 continued

Lesions 91-92: bumpy growth at end of articular circumference of ulna. Corresponds with growth on right radius: lumpy osteophytes around edge of carpal articular surface, extending up to the ulnar notch.

GY-7 continued

Lesion 88: bumpy and ridged swelling across shaft of rib.

GY-8

Dental lesion 31: absence of both the left and right P4.

GY-14

Lesion 104: fusion of bones from proximal portion of dorsal side. Fusion not wide-spreading - absent on palmar side.

GY-20

Lesion 108: oblique fracture of 70 degrees on distal end, around area of popliteal surface. Bone healed at slightly awkward angle - distal half has been displaced several mm in a caudal direction before healing. Displacement substantial enough that broken bone angle may have pierced through the skin before healing.

Houghton Down

HD-1

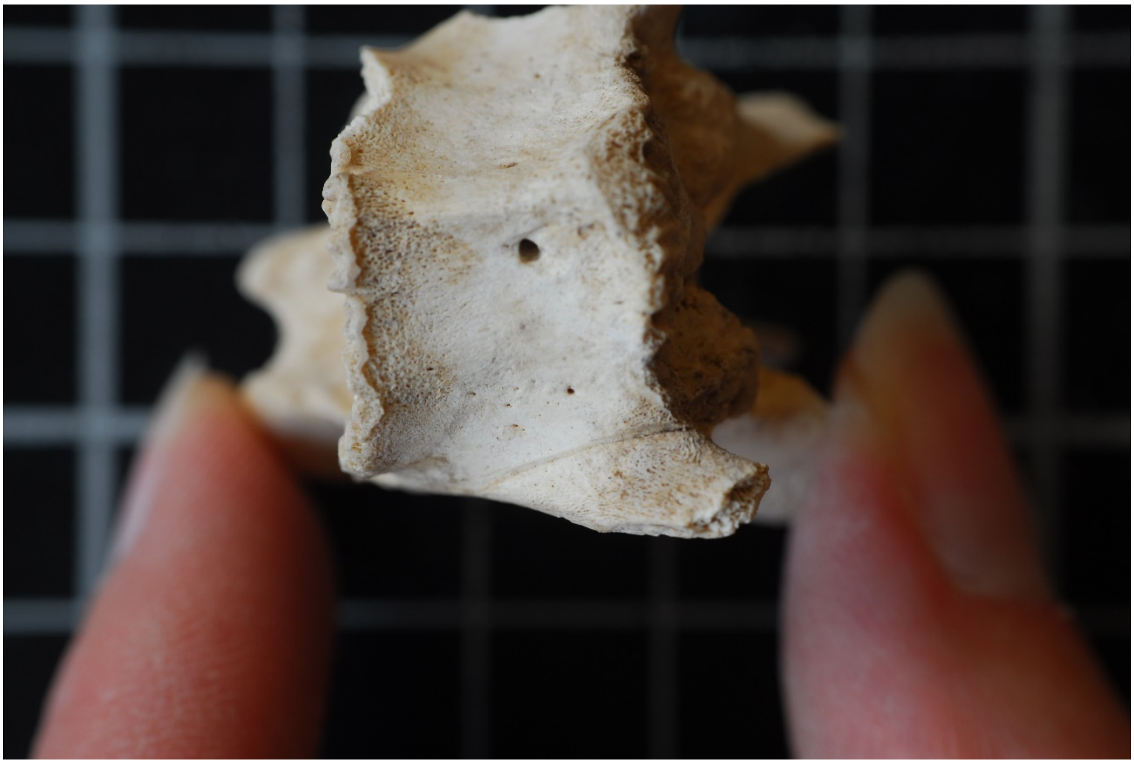
Tooth lesions 64 and 65: calculus on canine and upper P2.

HD-2

Butchery mark 15: multiple transverse cuts across the sacrum wing (on left side - matching the vertebrae cuts).

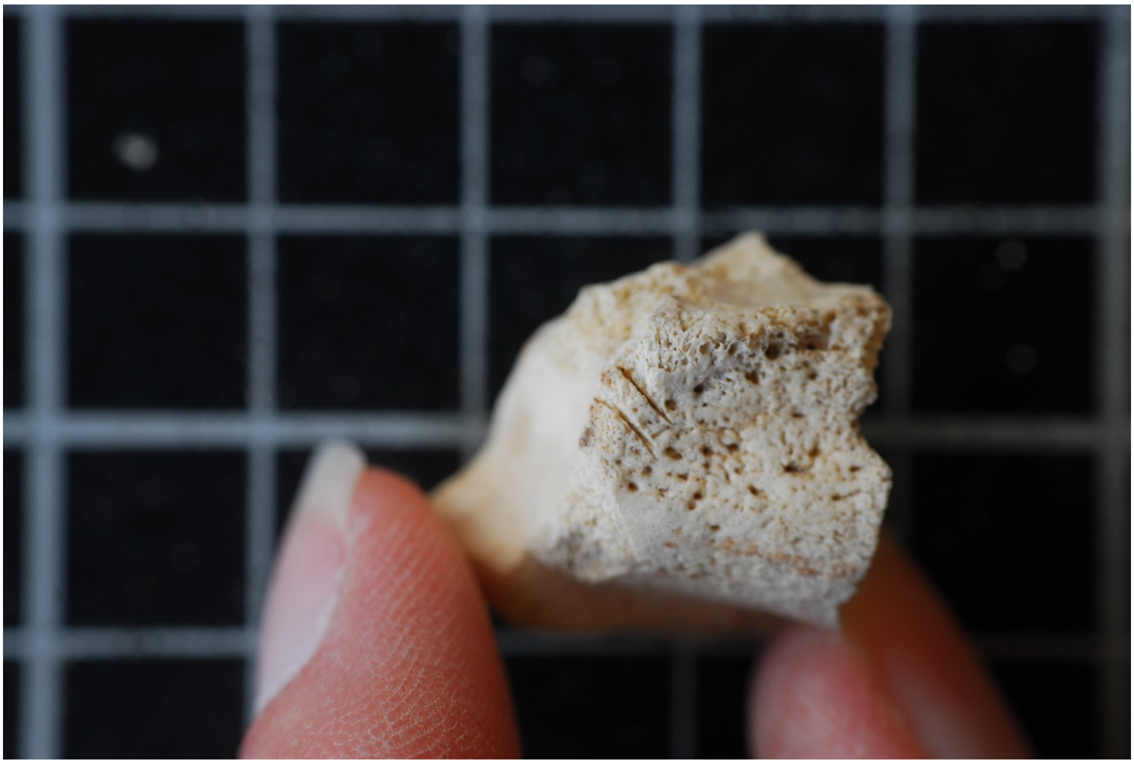
HD-2 continued

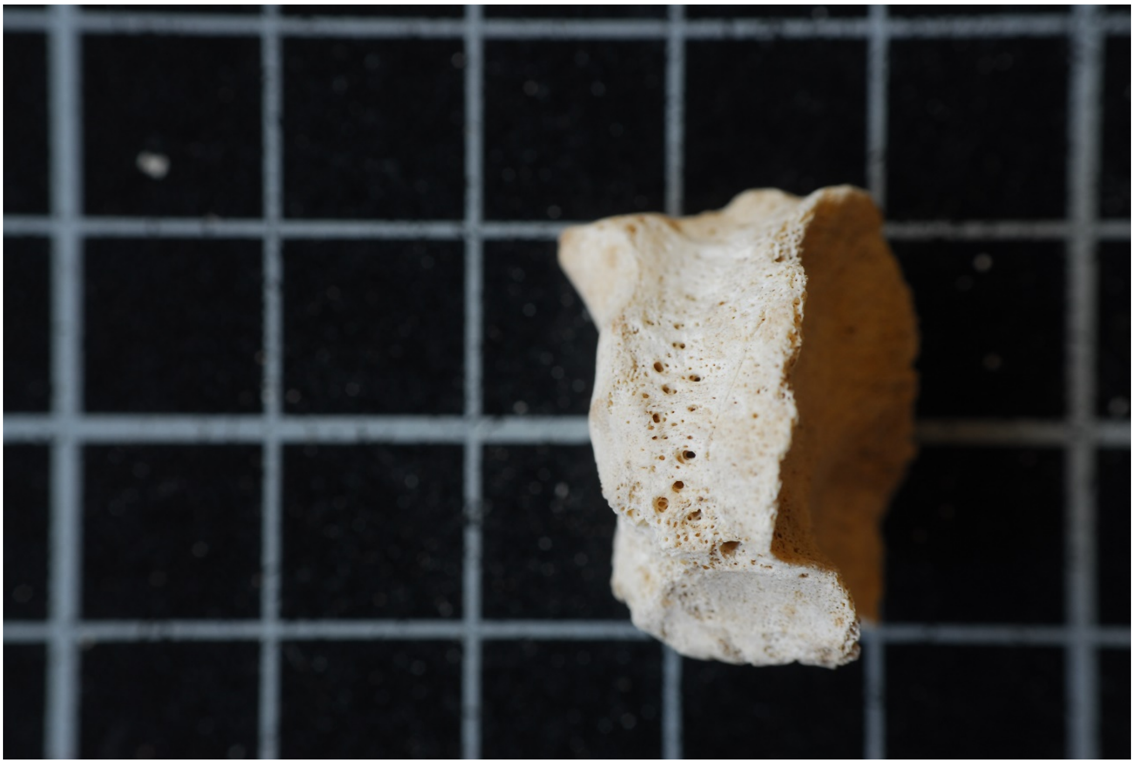
HD-2 continued



Butchery marks 11-14: multiple transverse cuts across the distal side of the left transverse process of the vertebrae, very close together. Couple of very faint cuts on right transverse process.

HD-2 continued

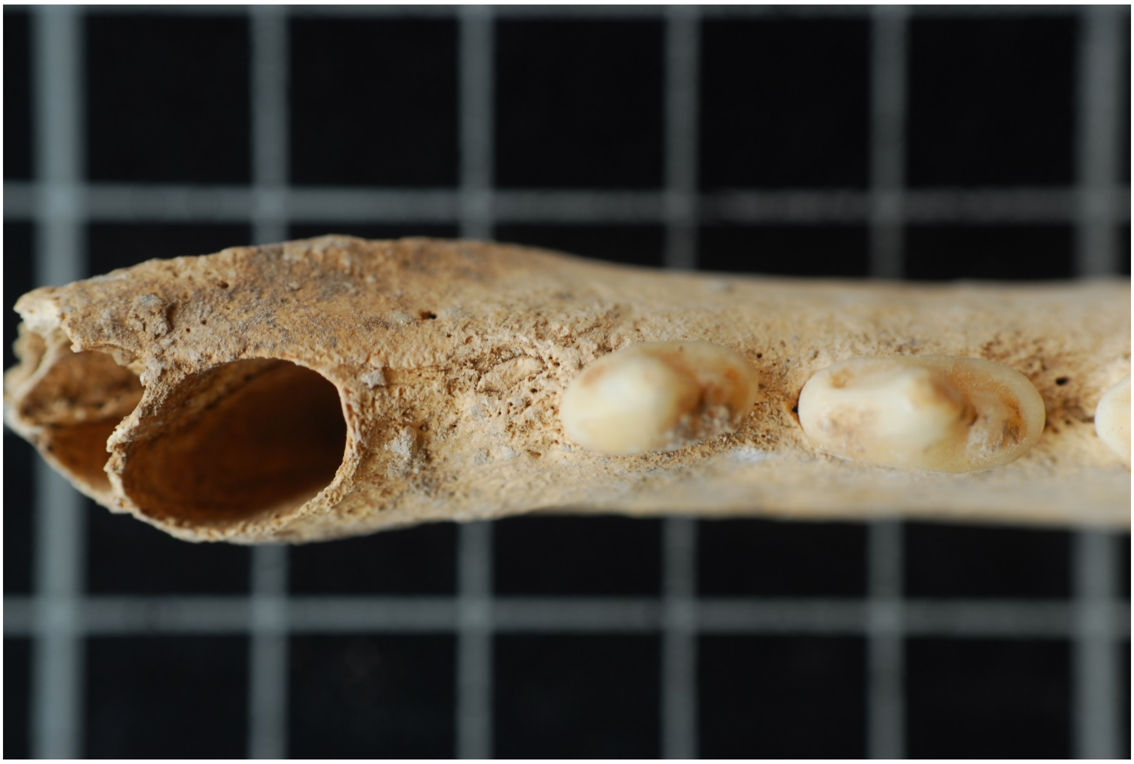




Butchery mark 16: multiple diagonal cuts across and slightly below the ulnar notch of radius.

Little Somborne

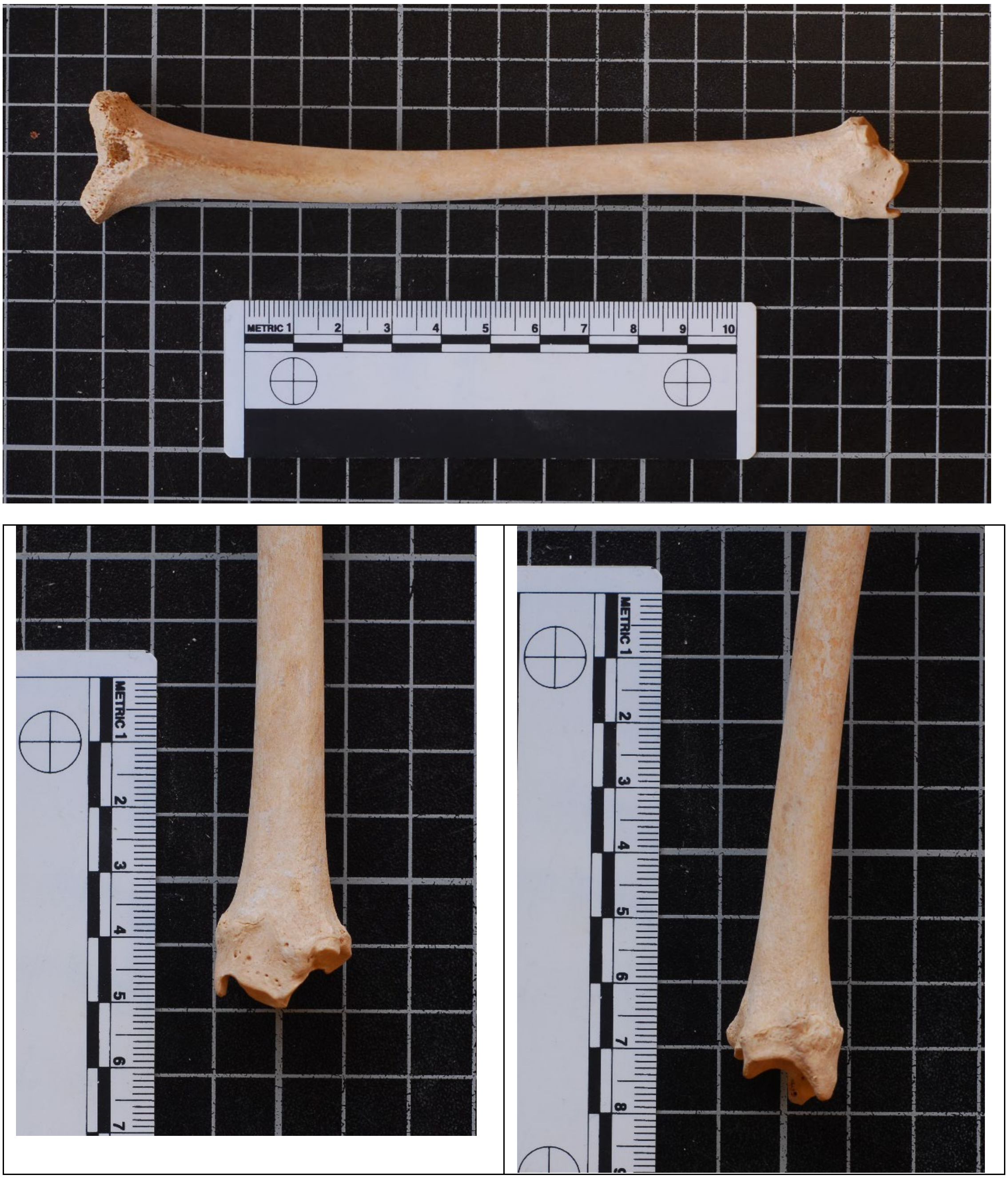
LS-1



Dental lesion 52: ante-mortem loss of P1, with alveolus infilled. Tiny frag of tooth visible in alveolus, indicating tooth was broken.

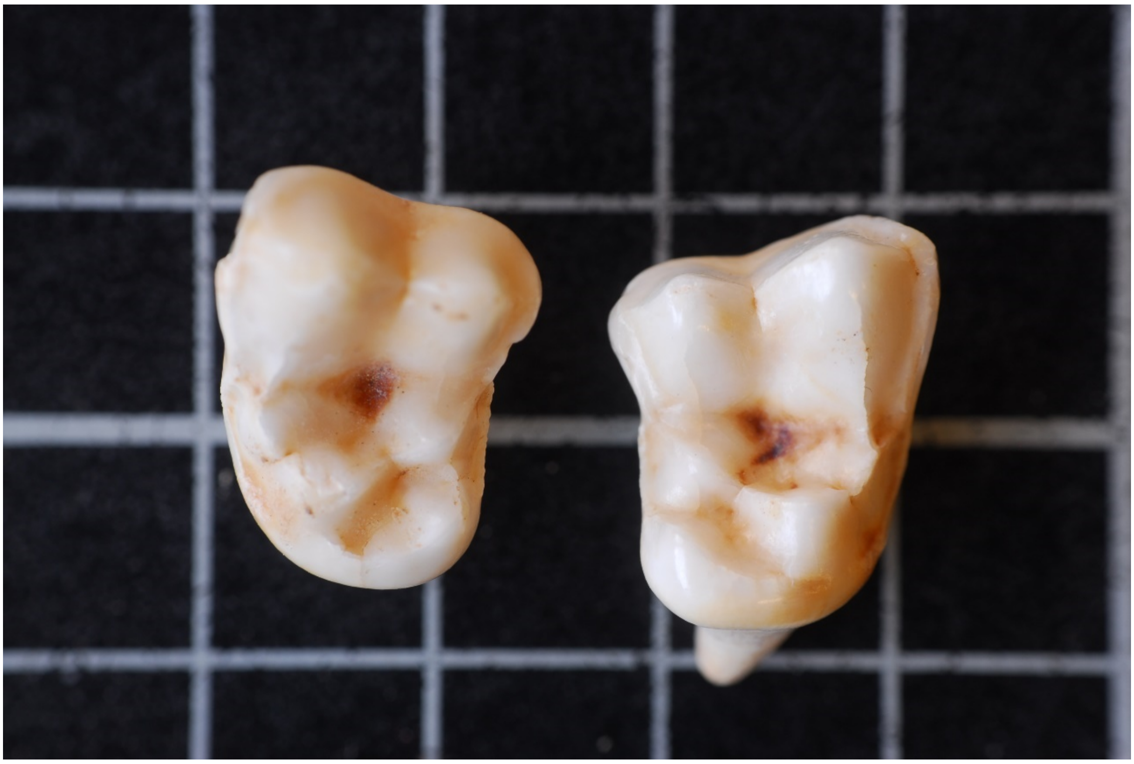
Nettlebank Copse

NC-2



Lesion 33: central part of medial malleolus at distal end of tibia is unusually elongated.

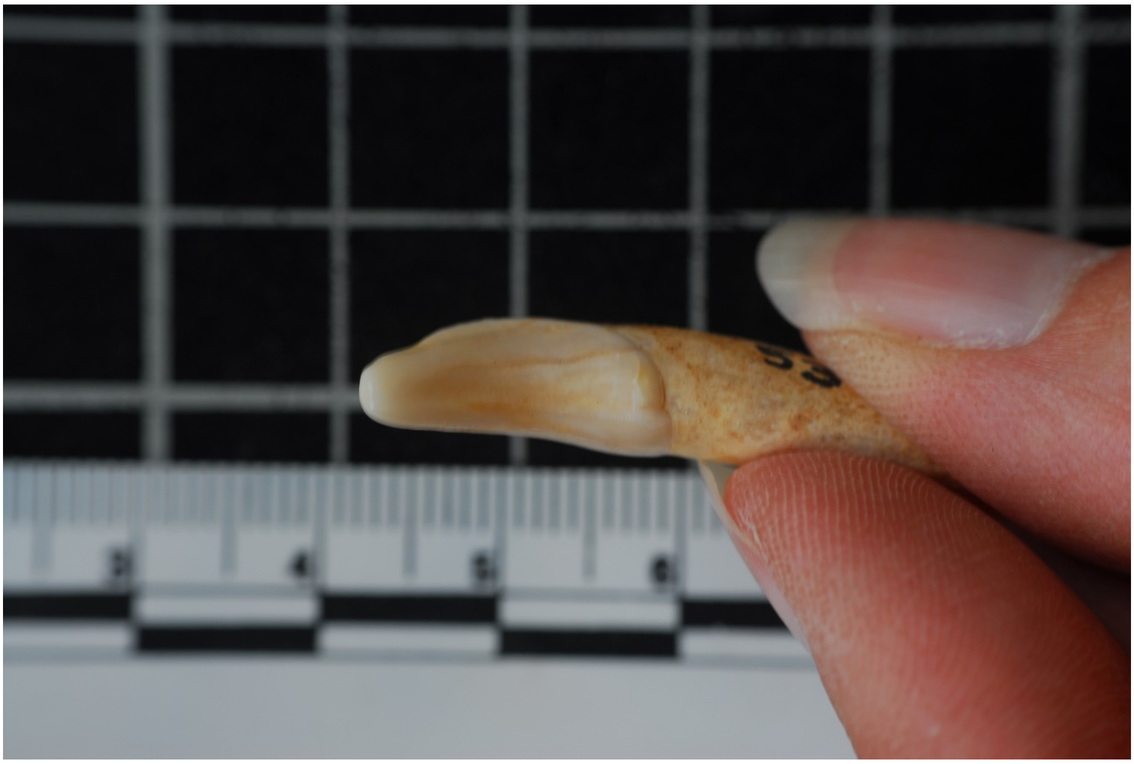
NC-2 continued



Dental lesion 10: stage 2 caries: black colour and slight pitting in central pit of occusal surface.

Oakridge Well

OAK-1



Not a lesion, but extra cusp on canine. Noted on several of the dogs.

Owslebury

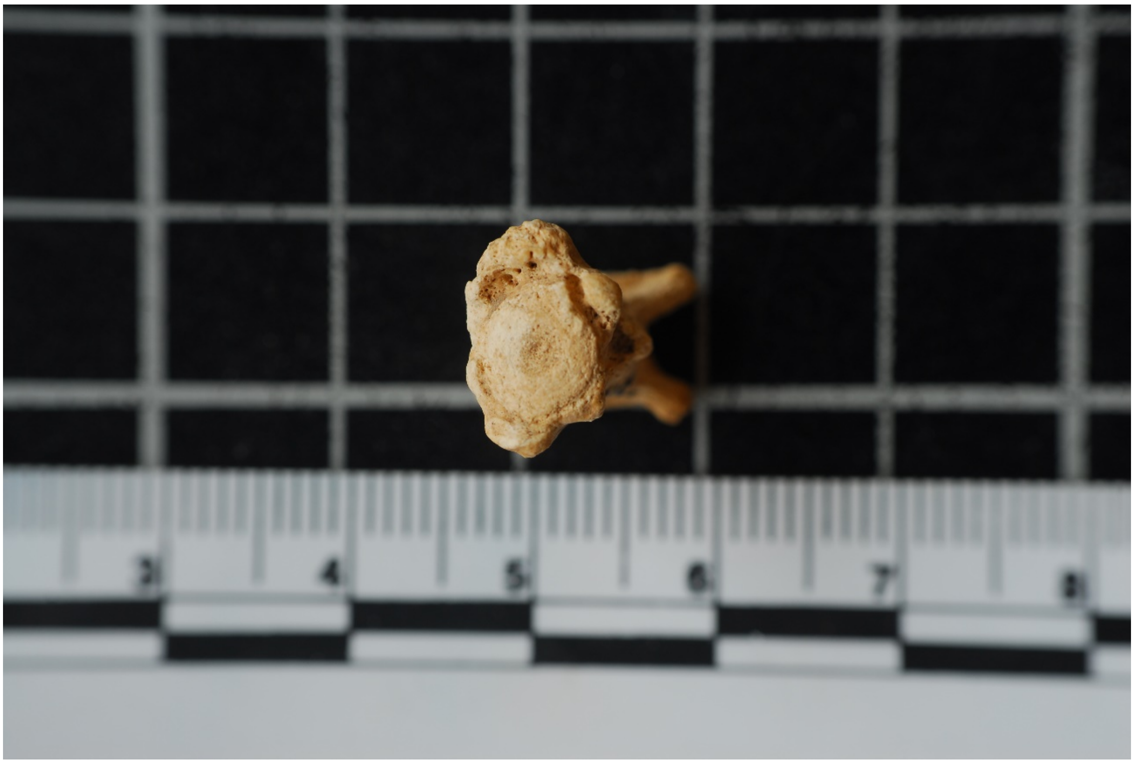
OW-1

Lesions 101 and 102: unusual articular grooves on proximal epiphyses of tibiae.

OW-5

Dental lesion 37: in the place of the M3, there is an extra root next to the standard size root for the M3 (at the end of the tooth row).

OW-5 continued



Lesion 120: unusual growth on the left hemal process, appearing somewhat larger than the right with a more bulbous appearance.

OW-8

Lesion 129: fracture of humerus - initial break underneath the deltoid tuberosity, at the musculospiral groove, at a 60 degree angle. Heavily foreshortened after healing.

OW-10

Lesions 130 and 132: ridged, bumpy growth around the articular surface of the ilium, and raised, smooth growth on lateral aspect of iliac crest - looks close to healed. At site of middle gluteal muscle attachment.

OW-10 continued

Lesions 136-138: swelling at site of ulnar attachment in radius and ulnae. In both cases, depressed and porous in the center.

OW-10 continued

Lesion 131: large irregular proliferation of bone at site of collateral ligment attachment, just beneath the head on the medial side.

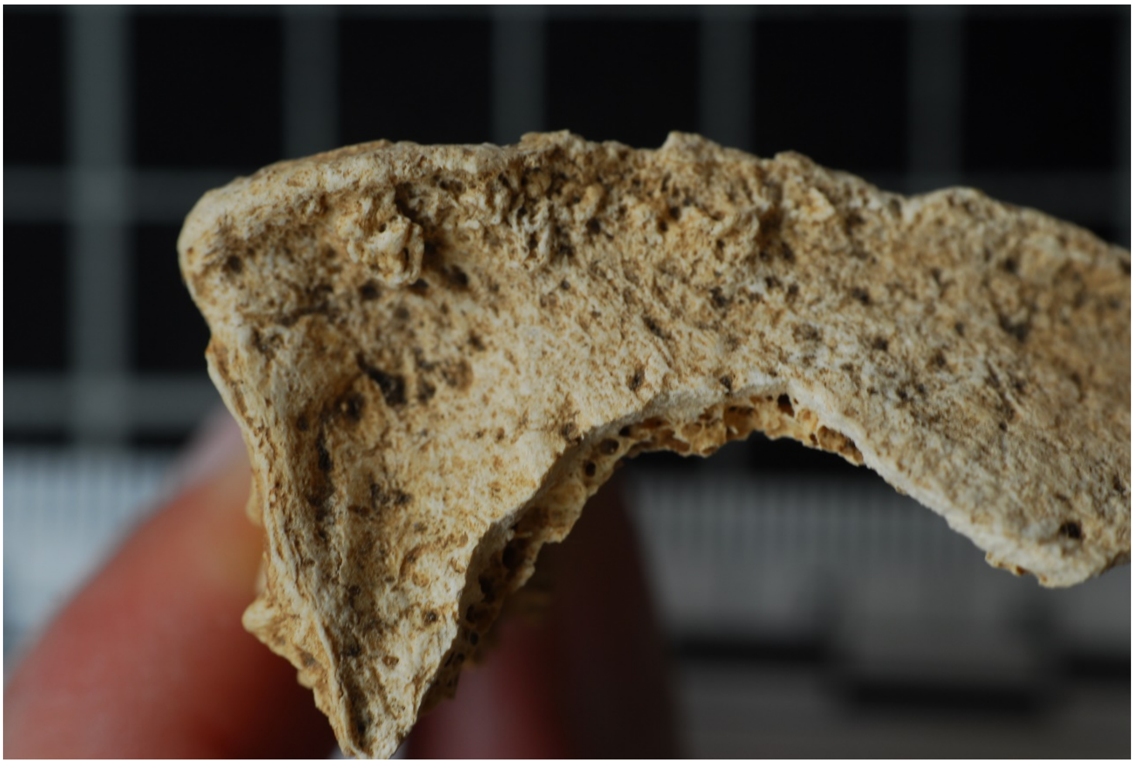
OW-13

Lesions 152 and 230: irregular porous, spongy growth at irregular intervals across midshaft. Trabecular bone in medullary cavity of shaft: bone broken post-mortem.

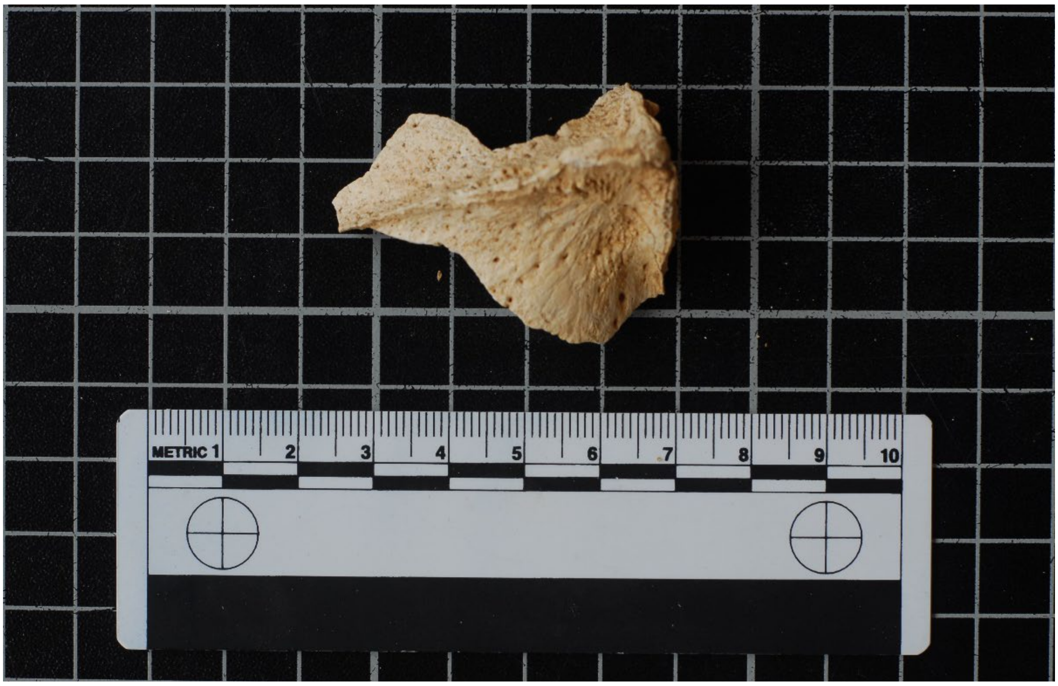
OW-13 continued

Close-up of trabecular bone in medullary cavity.

OW-14



OW-14 continued



Lesion 154: line of enthesophytes at interparietal process, just before the sagittal crest. Most on right side and small (<1mm), aside from large one at nuchal end (c. 2.5mm).

OW-18

Lesion 178: oblique fracture of rib.

Suddern Farm

SF-1

Lesion 34: transverse fracture at midway point of rib - periostosis around healed fracture.

SF-1 continued

SF-1’s stomach contents when it died: series of partially digested cattle carpals.

Appendix D: Database of ABG Data (digital)

Appendix E: Database of Secondary Data (digital)

These files may be downloaded at:

https://doi.org/10.25392/leicester.data.12357392