Global Hunting Adaptations to Early Holocene Temperate Forests: Intentional Dog Burials as Evidence of Hunting Strategies

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How to cite:

PERRI, ANGELA,RAY (2013) *Global Hunting Adaptations to Early Holocene Temperate Forests: Intentional Dog Burials as Evidence of Hunting Strategies*, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/8508/

Abstract

Global Hunting Adaptations to Early Holocene Temperate Forests: Intentional Dog Burials as Evidence of Hunting Strategies

Angela Ray Perri

The close connection between humans and dogs in the prehistoric past, often with a focus on a hunting relationship, has long been proposed, yet has rarely been evaluated. This thesis investigates parallels in environment, culture, adaptation and dog mortuary phenomenon among three complex hunter-gatherer groups in the early Holocene. Although dog domestication appears to have occurred in the late Upper Palaeolithic, the first instances of intentional, individual dog burials are not seen until after the Pleistocene-Holocene Transition. These burials appear nearly simultaneously among culturally and geographically unrelated early Holocene complex hunter-gatherers in three distinct locations: the midsouth United States, northern Europe and eastern Japan; coinciding with the onset of significant postglacial warming that triggered dramatic environmental change throughout the northern temperate zone; specifically the establishment of temperate deciduous forests. Along with this new environment came new ungulate prey species, and with the new prey species important hunting adaptations by humans. Ethnozooarchaeological fieldwork conducted with modern hunters in the United States and Japan, along with additional ethnographic material confirms the use of hunting dogs in temperate deciduous forests as a preferred method which yields improved results, in contrast to boreal forests or open tundra, where dogs can be a detriment. In densely forested environments, prey species often rely on concealment, rather than flight, to escape predators and human hunters. Dogs give vital assistance to hunters in these conditions, performing superhuman tasks such as locating concealed prey, tracking wounded animals, and bringing them to bay. This thesis presents a previously unidentified link between the first worldwide occurrences of individual, intentional dog burials and changes in hunting environments and prey species brought about by early Holocene climate change.

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Bronze ceremonial bell (*dotaku*) depicting dog-assisted boar hunting from Kagawa Prefecture, Japan (photograph: Tokyo National Museum)

Submitted for the qualification of PhD in the Department of Archaeology, Durham University
June 2013

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List of Abbreviations

ABG	Associated Animal Bone Group
BP	Before Present
ET	Effective Temperature
GISP2	Greenland Ice Sheet Project 2
GS1	Greenland Stadial 1
IMS	Interior Midsouth
KY	Kentucky
OAS	Original Affluent Society
SMA	Shell Mound Archaic
TN	Tennessee
WPA	Works Progress Administration

Abbreviations used in appendices:

ACH	Aichi Prefecture
AL	Alabama
B	Bluff Site
BP	Before Present
C	Cave Site
CHB	Chiba Prefecture
CO	Country
DB	Dog Burials
DK	Denmark
EHM	Ehime Prefecture
FSH	Fukushima Prefecture
GG	Grave Goods
I	Island
IBA	Ibaraki Prefecture
IL	Illinois
INJ	Injury
IWT	Iwate Prefecture
JP	Japan
KAN	Kanagawa Prefecture
KY	Kentucky
MO	Missouri
MYG	Miyagi Prefecture
N	No
NAG	Nagano Prefecture
NL	Netherlands
O	Open Habitation Site
PP	Prepared Pit
REF	Reference
RG	Region
RS	Rockshelter
SAT	Saitama Prefecture
SHZ	Shizuoka Prefecture

SM	Shell Midden
SW	Sweden
TN	Tennessee
US	United States
Y	Yes

The work contained in this thesis has not been submitted elsewhere for any other degree or qualification and unless otherwise referenced is the author’s own work.

Acknowledgements

Many people played a role in the completion of this PhD, to all of whom I am indebted. I especially thank my primary supervisor, Peter Rowley-Conwy, for his constant patience, support, and guidance, always infused with his special brand of wisdom and humor. I hope his influence is evident in this work. Thanks also to my second supervisor, Mike Church, for his very helpful comments and suggestions, which have no doubt improved this final thesis. I would also like to thank those who acted as mentors and inspiration, particularly Ken Ames, Terry Martin, Greger Larson, and Virginia Butler. I have been privileged to have received their advice and support.

Many people and institutions have played a significant role in the completion of this thesis including Bonnie Styles, Eric Grimm, and everyone at the Illinois State Museum; and Akira Matsui, Masashi Maruyama, and everyone at the Nara National Research Institute for Cultural Properties. I would also like to thank all of the people who have ever shared their insights, thoughts and opinions about my research, in person or over email. There are many, many individuals who are owed recognition and I am incredibly grateful to them all.

My time in Durham was enhanced by a small group of incredible people who contributed to both my research and my sanity. Dan Lawrence, Clare Wills-Lawrence, Sira Dooley-Fairchild, Jen Fitton, Tom Fitton, Emily Blake, Lindsay Powell, Michaela Binder and Helen Drinkall, I thank you for your friendship.

Funding was provided for various parts of this research by the R. Bruce McMillan Internship (Illinois State Museum), the Great Britain Sasakawa Foundation, the British Association for Japanese Studies, the Japan Foundation, the Rosemary Cramp Fund, Ustinov College (Durham University), the Dienje Kenyon Fellowship (Society for American Archaeology), the Tweedie Exploration Fellowship (University of Edinburgh), the John Crump Studentship (British Association for Japanese Studies), and the Birley Bursary.

I would also like to thank all the dogs who have been an important part of my life, past and present, including Jasmine, Dakota, Nog, and especially Darby and Finnigan. A special thank you to Sugarbear (Puddy), who taught me more about the deep human-dog connection than any research ever could.

Finally, I thank my family for their constant support and encouragement. Thank you especially to my mother, Mary, to whom this thesis is dedicated, for everything.

Chapter 1: Introduction

Introduction

Current research suggests the domestication of dogs occurred around 15,000 years ago, with the location and number of individual domestication events debated (e.g. Germonpré, et al. 2009; Gray, et al. 2010; Larson, et al. 2012). Although domestication appears to have occurred in the late Upper Paleolithic, the first instances of intentional, individual dog burials (for a precise definition of this see Chapter 3) are not seen until the beginning of the early Holocene (e.g. Morey 2010). The initial occurrence of these burials appears nearly simultaneously in several culturally and geographically unrelated locations: the midsouthern United States, northern Europe, and eastern Japan. While these burials are often discussed in the archaeological literature of the locality in which they are found (e.g. Larsson 1994; Morey 2006; Naora 1973), a heavily regional focus in their analysis, and in the archaeological literature in general, has precluded any cross-comparisons with similar burials in other locations thus far. A need for a global comparative analysis of archaeological phenomenon has often been stressed by researchers, most recently by Peregrine (2004) and Smith (2012), yet it is acknowledged that these assessments can be hindered by a lack of well-defined samples, objectives, and units of analysis (e.g. Peregrine 2004; Tainter 1978). Given this, a global analysis of any archaeological phenomenon, such as the case of intentional dog burials here, must address these issues in order to be both comprehensive and reliable.

A crucial part of this research is the examination of ethnographic and modern data on the hunting use, relationship, and mortuary treatment of dogs among subsistence and sport hunting groups. The nature of the archaeological record means the material remains represent a biased sample; an incomplete picture of past human behaviors and activities (e.g. Wobst 1978). As there is no direct way to observe exactly how hunting dogs may have been used in the past, we must rely on models and analogies to inform the observed patterning (e.g. Binford 2001; Hamilakis 2011; Morey 2006; 2010). Whilst imposing concepts derived from modern hunter-gatherer behavior upon prehistoric groups in the past can be problematic (e.g. Gould 1978), it is appropriate to use the ethnographic record to speak to the range of modes of interaction possible between hunter-gatherers and their dogs (discussed in Chapter 7). Furthermore, the ubiquitous use of dogs in hunting strategies across both time and space suggests that their added value supersedes particular local cultural variations. This is not to say that culture does not play a significant role in the actual manifestation of human-dog relationships, but that the benefits of using dogs in hunting in certain situations are so great that they are rapidly adopted (see Chapter 7). In this way, the study of ethnographically-observed relationships between human hunters and their dogs can serve as a framework for possible interpretations in the past (e.g. Ikeya 1994; Koster and Tankersley 2012; Lupo 2011b; Mitchell 2008; Nobayashi 2006; Skibo 2009; White 1972; see Chapter 7). The models used to interpret the recent ethnographic record are further integrated into the wider interpretation of the archaeological data.

This study attempts to provide an objective and cross-culturally valid method for comparing global prehistoric dog mortuary data, with a specific focus on dog burials from prehistoric hunter-gatherer sites. Once a typology of these burials is established (see Chapter 3), it will be used to compare, globally, incidences of a particular type of burial ('isolated burial'; see Chapter 3) in the prehistoric past, from their initial occurrence in the archaeological record. Once incidences of these burials are identified and described, it will investigate possible explanations for the parallel occurrence of this particular phenomenon within culturally and geographically unrelated regions, evaluating other similarities which exist between them, including palaeoenvironments, and archaeological evidence for levels of complexity, economy, and subsistence. Towards this objective, this thesis employs a systematic global literature review to identify and analyze these similarities in regions which possess prehistoric dog burials from the time of their initial occurrence in the archaeological record. It utilizes original site reports, faunal assemblage records, palaeobotanic records and ethnozooarchaeological accounts in order to build a comparative framework by which to objectively evaluate the three regions discussed. Laboratory and field research was conducted in the United States and Japan, consisting of an extensive literature review (including the first western-language translation of the majority of the Japanese material), hands-on analysis of several of the dog remains, and field observation of dog-assisted hunters. It also documents zooarchaeological changes in prey species types between the late Pleistocene and early Holocene to establish a clear chronology of subsistence species reliance over time, and site-specific palaeoenvironmental data (specifically, palynological) are compared from the late-glacial Upper Pleistocene and early Holocene records in each area to examine the rate, intensity, and nature of environmental change during the Pleistocene-Holocene transition. Using previous ethnographic research, as well as my own ethnozooarchaeological work with dog-assisted deer and boar hunters in the United States and Japan, it explores recent use of hunting dogs in an effort to consider possible correlations between human hunters, environments, prey and hunting dogs in the past. Thus, this thesis integrates faunal, palaeoenvironmental, mortuary and ethnographic records in order to characterize the dynamic relationships between complex hunter-gatherer groups, their environments, and the role of dogs in early Holocene hunting adaptations. The phenomenon of intentional dog burials appears to begin abruptly and concurrently with the influx of the deciduous oak-based forests in each of the three locations, corresponding to similar rapid biome shifts after the Pleistocene-Holocene transition, suggesting a relationship between the environmental change, socio-economic practices, and the appearance of the burials. This thesis aims to explore this hypothesis through a cross-comparative analysis of the archaeological and environmental data, with insight incorporated from the ethnographic record.

The Meaning of Dog Burials

The dog in ancient, ethnographic and modern time has always occupied a liminal position, neither man, nor beast; existing outside of the "wild" animal kingdom, but not fully belonging to the human sphere (Ambros 2010; Fitzgerald 2009; Radovanović 1999; Russell 2010; Sharp 1976). Their burial, in various geographic locations, chronological periods, and cultures, has been widely discussed, with explanations usually deemed either sacred or secular, ritual or rubbish (e.g. Maltby 1985; Morey 2010; Morris 2011; 2012; Olsen 2000; see Chapter 3). While intentional dog burial has certainly been part of human cultural activity, now and in the past, this thesis documents their first, parallel appearance in the archaeological record, which occurs nearly simultaneously in three early Holocene complex hunter-gatherer groups which inhabit the aquatic riverine and estuary-deciduous forest ecotone of the northern temperate zone. In these regions the intentional, individual burial of some dogs appears to have meaning beyond that of ritual sacrifice or discarded rubbish, with a level of mortuary treatment equal to (or in some cases, greater than) their human counter parts.

Researchers such as Kroeber (1927) and Ucko (1969) have argued that there are few cross-cultural regularities among burial practices of different groups and that burials are a '... disposal of the dead (that) falls rather into a class with fashions, than with either customs or folkways, on the one hand, or institutions, on the other' (Kroeber 1927: 314). Others have argued against this viewpoint, stating that burials reflect patterns of social organization and structure (e.g. Binford 1971; Goldstein 1981; O'Shea 1996). Saxe (1970) and Binford (1971) in particular set forth the framework for inferring social characteristics through mortuary data, with Binford (1971; see also Tainter 1978) contending that variability in mortuary practices must be understood in terms of variability in social systems. While in reference to human mortuary behavior, these arguments can be applied to dogs which were afforded human-like treatment in death, and to the cross-cultural analysis of these types of burials on a global scale. A comment made by Tainter (1978: 122) over 30 years ago highlights an issue in archaeological research that continues today,

> *Failure to consider the important concept of dimensions of differentiation has led archaeologists to derive an impressive array of information about past societies, but has rarely led to the production of information that is comparable.*

While there has been a recent increase in contributions to comparative archaeology (e.g. Earle 1997; Lawrence 2012; Peregrine 2004; Smith 2012), comparisons of global phenomenon in archaeology are still wanting. Peregrine (2004) noted several issues with diachronic global comparative analyses in archaeology, including the lack of representation of the entire range of variation or obviously comparable units of analysis. He has stated that a primary issue with current attempts at global comparisons is that they 'seem to lack…the very things that give comparative ethnology its strength—large and well-defined samples, well-defined units of analysis, and appropriately employed statistics' (Peregrine 2004: 295). In terms of global mortuary behavior, Tainter (1978) echoed these arguments early on, stating comparative frameworks need to develop general principles ensuring they are objective and cross-culturally valid. Therefore, to appropriately analyze the cultural phenomenon of intentional dog burials on a global scale, this thesis incorporates a typology of prehistoric dog mortuary treatment which defines comparable units of analysis, allowing an objective and cross-culturally valid assessment (see Chapter 3).

In a discussion of prehistoric mortuary practices in the midsouth United States, Rothschild (1979: 660) stated,

> *It is assumed that distinctions visible in mortuary practices reflect status distinctions visible during life. If patterns exist in mortuary practices, it is assumed that they relate to structural divisions in society.*

Though in reference to human mortuary practices, if these distinctions are applied to the dog mortuary record across the three regions discussed in this thesis, similar features are apparent. In all the sites considered, dogs are present in the archaeological record in a variety of ways (see Chapter 3). Individual elements, some with evidence for skinning or butchery, are found scattered around sites and within trash middens. At some sites single dog elements have been included in human burials, while complete dog remains have been included in others. This variation in mortuary treatment makes the finding of individual, intentional dog burials, identical to their human counterparts, even more remarkable. The very fact that an animal would be afforded a burial on par with humans indicates some level of elevated status. It is clear that some dogs were being treated in a very distinct way, which was likely a reflection of their role during life. The ambiguity of a dog in a complex hunter-gatherer society is, in itself, complex. The dog's constant categorization as neither person, nor beast (e.g. Radovanović 1999) leaves it in a marginal position, much like infants and children (e.g. Fahlander 2008). Yet, its value as an important hunting adaptation (as seen in modern and ethnographic examples; see Chapter 7) affords the possibility of status, a living weapon which at its core holds a liminal social position within the human group, but can be elevated to full 'personhood' based on its skills as an 'individual' in an transegalitarian society.

The fact that the complex hunter-gatherer groups described in this thesis are all generally categorized as transegalitarian societies is significant. The use of the term 'transegalitarian' here allows for the possibility of minor inequalities which may exist based on age, sex, family position, etc., but refers to groups which do not support private ownership of resources, political dominance or institutionalized hierarchies (Clark and Blake 1994; Hayden 1995; 2007). The term 'transegalitarian', popularized by Clark and Blake (1989) and Hayden (1995) has alternatively been referred to as 'middle-range', 'tribal', 'ranked', or 'stratified', but the term 'transegalitarian' is preferred here in reference to groups which are neither purely egalitarian or politically stratified. The complex hunter-gatherers of the Archaic midsouth United States, Mesolithic northern Europe, and Jomon eastern Japan have all been described in such terms (see Chapters 4, 5, 6, and 8). In transegalitarian societies, status is accumulated during the life of the individual based on their role in the group, such as a skilled hunter or shaman. In death, this acquired status is then often reflected in burial, with the deceased being offered special treatment such as grave goods or being covered with red ochre. This thesis proposes that in life, and thus in death, the social position merited by those hunting dogs which proved skilled and valuable hunting tools was on par with that of skilled human hunters. This proposition is supported by ample evidence from the ethnographic record, which shows the superhuman proficiencies of a dog (e.g. scent-tracking, chasing, holding prey) can prove invaluable to many hunter-gatherer groups, leading to their venerated status as a group member, and eventual human-like burial (see Chapter 7). Though the probability that dogs in prehistoric foragers groups were being utilized as hunting assistants has been widely proposed (e.g. Clutton-Brock 1995; Clutton-Brock and Grigson 1983; Morey 1992; 2010), the possibility that their deliberate burial in these groups was a reflection of their elevated status as esteemed hunters has gone unexplored. This concept is hinted at by Conneller (2011: 366) when she suggested,

> *… as ambiguous animals, existing between human and animal cultures, we can perhaps see particular dogs only as having the particular qualities that allowed them to be full participants in human ritual practices.*

Perhaps due to an inability to believe that some dogs, valued for their superior hunting capabilities, may have been afforded a burial equivalent to their human counterparts, archaeologists have proposed many other explanations for this phenomenon. At the Mesolithic Ertebølle site of Skateholm in southern Sweden (see Chapter 5), Larsson (1990a; 1994) has suggested that individual dog burials represent cenotaphs, substitutions for lost human bodies, while Strassburg (2000) has proposed burial due to their symbolic role as shape-shifters or shaman. Munt and Meiklejohn (2007: 167) have suggested intentional burials as 'real or symbolic protection to the encampment'. In contrast to what he proposes as 'the somewhat silly trend of ritualizing the past', Fahlander (2008: 36) has suggested that the Skateholm dog burials are simply the interment of 'dear members of the household'.

While Fahlander's proposal speaks to the notion that some dogs in hunter-gatherer societies may have been valued as pets, as they are today, it is probable that the buried dogs from Skateholm and the other sites described throughout this thesis warranted human-like status in burial due to their human-like (in fact, superhuman) hunting capabilities in life.

In addition to the phenomenon of isolated dog burials (see Chapter 3), this thesis highlights the many similarities shared between the complex forager cultures described. Individually, within the archaeology and literature of their respective regions, each area is considered a model example of a complex, semi-sedentary/sedentary forager population. Yet the possibility that they yield parallels which are observable in the archaeological record has gone largely unexplored. While the identification of similar isolated dog burials in each area is just one phenomenon explored here, the possibility of similar comparative studies among these and other prehistoric groups is necessary, as suggested by Tainter (1978: 122),

> *If the study of past social systems is ever to aspire to the study of social process, then archaeologists must develop the ability to model prehistoric societies in ways that yield comparable results. Two of the factors involved in the development of comparable social models are explicit consideration of the dimensions of a social system that are being investigated, and the development of cross-culturally valid criteria for isolating and measuring these dimensions.*

Aims and Structure

This study is divided into four sections to reflect its aims and objectives. Chapters 2 and 3 provide a background to understanding the archaeological, cultural and environmental setting on a regional and global scale. Chapter 2 places each of the three regions in their archaeological and environmental context, documenting important changes which took place before, during and after the Pleistocene-Holocene transition, and evaluating these changes across the three regions in a short comparative analysis. Chapter 3 presents a typology of archaeological dog burials, which I created through an extensive literature review of reported dog remains from prehistoric sites worldwide. This typology provides a definition of the intentional, individual dogs burials ('isolated burials'; see Chapter 3) described throughout this thesis and allows these burials to be distinguished from other archaeological dog remains, and thus comparatively evaluated. Chapters 4-6 provide a more detailed analysis of the early Holocene archaeology, environmental change, and dog burials examined in each of the regions. Chapter 4 deals with the midsouth region of the United States first, as it has the most extensive record of dog burial sites, number of individual dog burials, and archaeological literature discussing these burials. Research for this chapter included laboratory and field work in the United States, observing dog-assisted hunters, examining some of the dog burial remains, and collecting data from grey literature. I then move on to Chapter 5, covering northern Europe, which comprises significantly fewer burials than the other two regions, but has a wide-ranging body of literature discussing the mortuary treatment of dogs in prehistoric hunter-gatherer groups. Finally, I examine eastern Japan (Chapter 6), which has a large record of dog burials, but from which there is very little published in the western-language literature, leaving it nearly unexplored outside of Japan. In researching this chapter I made a three-month research trip to Japan where I worked with modern dog-assisted boar hunters and archaeological researchers at the Nara National Research Institute for Cultural Properties. The result is the first comprehensive, English-language publication of the Jomon-period dog burials (Chapter 6). Chapter 7 provides an extensive survey of ethnographic and modern examples of the role of hunting dogs in subsistence hunter-gatherer and sport hunting groups. Though not intended to claim precise analogies between ethnographic and ancient cultural activities, this chapter provides practical insight into the possible uses of hunting dogs in the prehistoric world. Chapter 8 comparatively analyzes the data presented in the preceding chapters and discusses additional theoretical arguments for the use of hunting dogs in prehistoric forests. The concluding Chapter 9 provides a summary of the main conclusions of the study and suggests some future research directions.

To summarize, the aims of this thesis may be stated as follows:

- To develop a typology that allows for the mortuary treatment of prehistoric dogs to be analyzed in a way which is objective and cross-culturally valid
- To use this framework to identify and analyze analogous occurrences of intentional dog burials to create a dataset which can then be compared on a global scale
- To further compare the archaeological, environmental, and cultural histories of regions which have parallel incidences of intentional dog burials (the midsouth United States, northern Europe, and eastern Japan)
- To analyze the use of dogs as hunting weapons, through modern and ethnographic records, specifically in temperate deciduous forest environments with ungulate woodland prey species
- To assess whether the parallel occurrence of early Holocene dog burials in three unrelated regions is the result of dog-focused hunting adaptations, due to rapid environmental change

The broad scale of this thesis places restrictions on the level of detail it is possible to cover. It does not attempt a full scale analysis of the archaeology, palaeoenvironmental change, and cultural phenomena of any of the regions discussed, each of which would require many theses in their own right, but instead seeks to organize and examine the data in a way that allows larger trends to emerge. It seeks to investigate possible parallels between (a) the economy and cultural practices of emergent complex hunter-gatherers in the early Holocene; (b) adaptations in hunting strategies associated with the post-Pleistocene deciduous forests (and their accompanying ungulate prey species) in the northern temperate zone; and (c) the intentional, individual burial of dogs during this time period.

Chapter 2: Archaeology and Palaeoenvironments

Introduction

This chapter will focus on the climatic and environmental change that occurred during the Pleistocene-Holocene transition, and discuss how these changes were reflected in the cultural adaptations of hunter-gatherers in each of the three study areas: the midsouth of the United States, northern Europe, and eastern Japan (Figure 2.1). Though in this chapter a brief overview is given of the general archaeology and palaeoenvironmental change that took place, a more comprehensive detailed history is given of each area in Chapter 3 (Midsouth United States), Chapter 4 (Northern Europe), and Chapter 5 (Eastern Japan). Though they display parallel traits which seem to lead to strikingly similar cultural adaptations, the cross-comparative analysis of three unrelated groups can prove challenging. Throughout this thesis the three cultural groups examined have been described as 'early Holocene' to reflect their chronological and cultural association with the Pleistocene-Holocene Transition. Though the Archaic and Jomon cultural groups are thought to begin earlier than the Ertebølle/Swifterbant, the similarities demonstrated between the three groups throughout this thesis are a manifestation of their analogous adaptations to the climatic and environmental change initiated in the early Holocene after the Pleistocene-Holocene Transition.

Prehistorians have long been aware of the importance of environment as a potential catalyst for change in human adaptive systems, but have traditionally emphasized local and regional relationships. The parallels between the three regions presented in this chapter, and throughout this thesis, emphasize the possibility that cultures which are geographically distinct may be adapting to climatic and environmental change in remarkably similar ways. The comparative analysis of these three regions reveals similarities not only in physical traits, such as climate, environment, latitude, and available prey species, but also in the cultural adaptations of the human populations. The traits which are generally shared by each of the groups include the following:

(a) geographically located in the northern temperate zone (between 30-60° N latitude) in an area which rapidly shifted to a temperate deciduous forest after the Pleistocene-Holocene transition

(b) a seasonally variable diet, with high reliance on aquatic resources (shellfish and fish), deciduous tree nuts and plants, and specifically deer and wild boar species

(c) semi-sedentary to sedentary settlements centrally located to maximize utilization of multiple transitional subsistence zones, such as estuary/coastline and forest upland (c1) early use of ceramics and storage pits as evidence of sedentism

(d) hunting technology designed for dense forest efficiency, specifically the bow and arrow and microliths

(e) large populations; high density and large settlement size

(f) the formation of shell middens after about 8,000 cal B.P.

(g) transegalitarian society with social status based on personal accomplishments during life

(h) burial of the dead in organized cemeteries, often in shell middens

(i) displays of territoriality and interpersonal violence

(j) extended practice of hunter-gather subsistence strategy in comparison to nearby groups

(k) intentional, individual burial of dogs

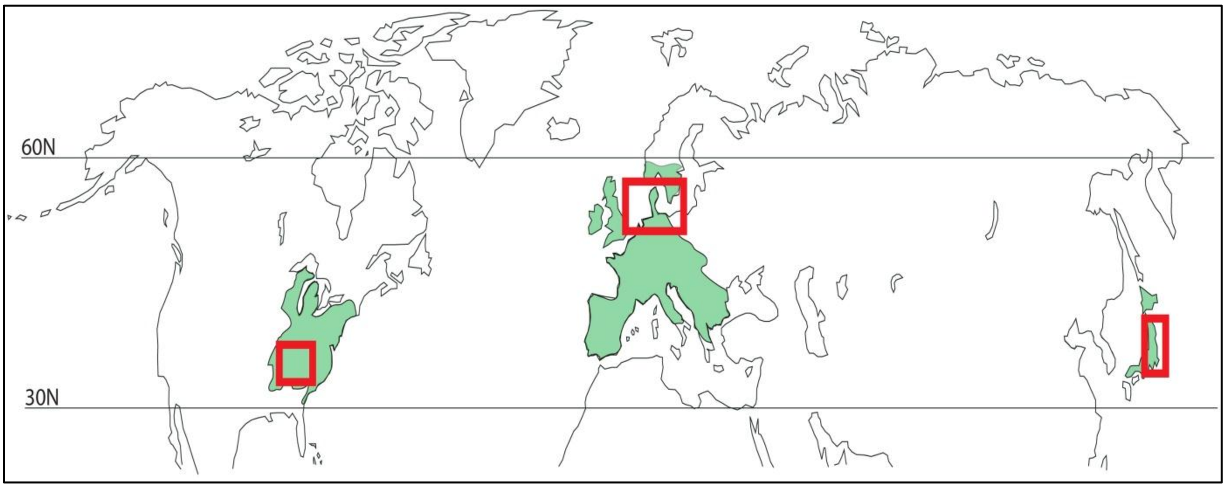


Figure 2.1. Map of the regions described in this chapter and thesis (the Midsouth United States, Northern Europe, and Eastern Japan, highlighted in red) with the maximum extent of the temperate deciduous forests during the early Holocene (green; after Adams and Faure 1997)

Though culturally and geographically unrelated, the foragers of the Archaic midsouth United States, Mesolithic northern Europe, and Jomon eastern Japan display remarkable similarities. During the Late Pleistocene and earliest Holocene in each of the regions, hunter-gatherers were highly mobile with hunting taking place on open tundra or in boreal forests, and targeting primarily megafauna or large herd animals, such as reindeer. The open habitat, size of the prey, and large herd numbers meant that Pleistocene hunters were at a significant advantage to track, stalk, and ambush prey, especially when hunting in a sizeable group. The oversized bifacial points and spears used were designed to penetrate thick skin and kill instantly, and a mobile lifestyle meant that groups could follow herd migrations and track animals for long distances. The significant environmental shifts that occurred as a result of climatic warming at the end of the Pleistocene forced hunter-gatherers to confront a changing world, with the option to follow the Pleistocene boreal flora and fauna they knew northward, or to adapt to the influx of new, warm-loving temperate species, which included the dense deciduous forest and its accompanying woodland fauna. In contrast to the open habitat of the Late Pleistocene, the oak-based temperate deciduous forests of the Holocene were thick and difficult to maneuver. The visual advantage over prey that Pleistocene hunters had once benefitted from on the open tundra and to some extent in the boreal forests was replaced by thick understory, which provided ample concealment cover for prey species. In addition to a change in vegetation, these prey species saw a significant shift as well. With the deciduous forests came the temperate woodland fauna, with the deer and wild boar species being the most important for early Holocene forager subsistence. Unlike the large herds of the Pleistocene, the deer and boar of the temperate forests were primarily solitary or lived in small groups, which would have increased hunting risk and lowered prey encounters. Moreover, these medium-sized ungulate species were well adapted to the temperate forest, with quick reflexes, advanced flight responses, extensive use of forest cover, and a tendency to lie up in forest undergrowth when wounded.

Early Holocene foragers in each of these regions adapted to this new way of life, and specifically the altered subsistence economy, in comparable ways. Although a sedentary lifestyle based around seasonal resources increased risk and the potential for mass subsistence failures (e.g. low nut masts and catastrophic disease in ungulate or aquatic resource populations), leaving procurement less predictable, flourishing forests and rising sea levels introduced more productive biota, such as the medium-sized forest ungulates, edible tree nuts and plants, and aquatic species. Foragers, attracted to the reliability and seasonal predictability of static resources, began settling around coastlines (in northern Europe and eastern Japan) and riversides (in the midsouth United States) in locations which provided optimal access to both these aquatic resources and nearby woodland resources (e.g. Andersen 1995; Claassen 2010; Fischer, et al. 2007a; Habu, et al. 2011; Hensley 1994; Price 1989). While a broad diet of aquatic and woodland resources (including nuts, which were important in all three regions) was important to these groups during this period, faunal remains illustrate that the prime subsistence targets were deer (in all three regions) and boar (in Europe and Japan) (e.g. Carter 2001; Madrigal and Holt 2002; Magnell 2005; Meltzer and Smith 1986). In comparison to the hunting of megafauna and large herd animals in the Late Pleistocene, the hunting of quick, solitary or small group ungulates through dense broadleaf forests would have required a significant adaptation in hunting tools and techniques (see Ahlén 1965; Clutton-Brock, et al. 1982; Haber 1961; Legge and Rowley-

Conwy 1988; Mitchell, et al. 1977; Strandgaard 1972). These adaptations are seen in all three regions with the advent of the bow and arrow, which is ideal for close-range forest hunting, and the microlith, which is designed to cause deep, bleeding wounds without necessarily killing on first impact (Bergman 1993; Bergman, et al. 1988; Churchill 1993; Friis-Hansen 1990). Due to heavy forest cover, which allowed quick concealment, and lower prey group densities, encounter rates for ungulate species in the dense temperate forests would have been lower than those of the Pleistocene. Additionally, with weapons designed to cut bleeding wounds in prey, there was likely a high rate of tracking and chasing needed before finally taking a wounded animal - a challenging task in a dense understory. As is seen in modern deer and boar hunters, the use of hunting dogs is one of the most effective hunting adaptations to minimize risk and maximize returns in closed temperate forests, but is of much less use in open country where they can be seen from a distance by prey animals (Figure 2.2; see Chapter 7). The instinctive nature of dogs to chase prey, combined with their superhuman capacity to track (especially with a blood trail) and hold prey so humans can make the final kill would have made them an essential part of the early Holocene dense forest-ungulate prey hunting strategy. It is this role as a critical weapon in the adaptation to early Holocene environments and prey species, in conjunction with the dog's inborn position as 'neither person, nor beast' in human groups, that I propose led to their careful and deliberate individual burial as a valued member of the group. This correlation between environment, hunting methods and efficiency, and individual dog burials is strengthened by the abrupt termination of dog burials in all three locations with the advent of agricultural dependence. These results show that groups of hunter-gatherers who were culturally unrelated and broadly geographically distributed were adapting to the warming environments of the early Holocene in significantly comparable ways.

Figure 2.2. A modern hunter stalking deer from a distance in the Scottish highlands. In this open environment dogs are a detriment as they can be seen and smelled by prey from long distances (photograph: Peter Rowley-Conwy)

The Pleistocene-Holocene Transition

The Younger Dryas period, which occurred in the northern hemisphere, was a stadial that took place between approximately 12,800 – 11,500 years ago during the Late Upper Pleistocene, the period immediately preceding the beginning of the Holocene. Named after the *Dryas octopetala,* an alpine tundra wildflower which is used as the indicator species for the stadial event, it is also commonly referred to as the Loch Lomond Stadial (in the United Kingdom) and Greenland Stadial 1 (GS1). This period saw a rapid return to glacial conditions in the higher latitudes of the northern hemisphere, after the warmer Bølling-Allerød interstadial previously. Isotopic data from the Greenland ice core GISP2 indicates that the summit of Greenland was approximately 15 °C colder in the Younger Dryas than it is today (Alley, et al. 2003: 7), and there are estimates that northern Europe was around 10°C cooler than today (Peteet 2000). Similar significant cooling trends were seen across other parts of the northern hemisphere as well (Keigwin and Lehman 1994; Mathewes, et al. 1993; van Asch, et al. 2012). In Scandinavia the boreal forests were replaced by glacial tundra, while in eastern Japan and the midsouthern United States the cooler climate ushered in the spread of conifers and other cold-loving evergreens. Along with cooling temperatures and the spread of boreal forests during the Younger Dryas, both Japan and North America saw the disappearance of megafauna species whose diets depended on the flora of a milder climate.

In general, the mobile hunter-gatherers of the Late Upper Pleistocene midsouthern United States, northern Europe, and eastern Japan had subsisted on diets which included the taking of these large herd megafauna, supplementing with other provisions such as nuts, water fowl, and small mammals in some areas. These boreal forest environments are considered among the most marginal environments for man, where game species can be rare and edible plant foods are lacking in abundance (Butzer 1964; Fitting 1968). Early on Hinsdale (1932: 7) suggested that Native Americans procured very little of their food resources from conifer forests, noting that the resinoid trees lacked the fruits, nuts, berries and sugars upon which their prey animals depended.

Around 11,000 years ago the northern hemisphere saw another dramatic climate shift with the beginning of the warmer Holocene period and the end of the Younger Dryas. The GISP2 core suggests the Younger Dryas may have ended as quickly as it began, within a time frame of just 40-50 years, while other proxy data suggests that the transition may have been even more rapid, with a warming of 7 °C occurring over a period of just a few years (Alley 2000; Alley, et al. 2003; Dansgaard, et al. 1989). In northwest Europe, and many other parts of the world, modern summer temperatures were established within the first 1,000 years of the Holocene. Deciduous forests in the northern latitudes, which had previously been pushed into refugia during the colder glacial period, were now flourishing and rapidly expanding into new territory. Opportunistic European genera like birch, ash and hazel expanded at rates of 1-2km per year over a period of 500-2,000 years, and in North America the deciduous genera like oak and hickory spread at rates of 0.5km per year (Roberts 1998). With this spread of deciduous forests into previously boreal forest environments there came a change in prey species and other subsistence resources. In contrast to the low productivity rates of the coniferous forest, broadleaf forests are optimal environments, with increased ungulate biomasses and a variety of edible plants, fruits and nuts, where high population densities would be expected (Fitting 1968). Mellars (1975) gave a range of 1,000-2,500 kg/km^2 for ungulate biomass in mixed deciduous forests, which is much higher than the 800 kg/km^2 for caribou in the Canadian tundra (Bourliere 1963) or the 440 kg/km^2 calculated for tundra by Whittaker (1975). Rowley-Conwy (1993) has discussed the important relationship between latitude and hunter-gatherer productivity, suggesting that flourishing temperate woodlands near productive temperate coastlines (and river banks in the case of the midsouth United States) would have created the overlapping patches over seasonally-available subsistence sources necessary to maintain a sedentary lifestyle. It was these optimal conditions which lead Caldwell (1958: 8) to describe deciduous forests as “living country” for hunter-gatherers.

The primary theme of the Pleistocene-Holocene transition worldwide was that it was a time of adjustment and adaptation to new environmental conditions. Coastal and riverine ecologies were affected by sea level rise and isostatic rebound of land, while vegetation responded to the climatic warming with shifting distributions. Increased temperature and moisture in the temperate deciduous forests encouraged canopy and understory growth, which increased biomass and net primary productivity of the environment. The temperate woodland faunal communities that accompanied the change in environment proved to be important prey species for hunter-gatherers, though new hunting methodologies and technology would have had to have been developed in order to successfully exploit them. The probability that hunter-gatherer groups in the boreal forests of the northern latitudes faced abrupt environmental changes within a few decades has led researchers to examine how humans deal with rapidly changing ecosystems and a sudden change in important resources (e.g. Straus 1996b). It is clear that forager groups in the early Holocene responded to large-scale environmental changes by adapting and reorganizing their settlement and subsistence patterns (Bonnichsen, et al. 1987). A key point for everything that follows is that this included the use of hunting dogs as an important dense forest hunting adaptation.

Return of the Temperate Forests

Roberts (1998: 99) has referred to the return of the forest ecosystems in the early Holocene as “one of the greatest stories of the Earth’s recent natural history”. The temperate zone of the northern hemisphere arguably saw some of the most significant changes, with a rapid influx of the warm-loving deciduous taxa, which Huntley (1993) has noted were restricted to the western and eastern margins of North America and Eurasia due to extremes in annual temperatures and precipitation in the continental interiors. That rapid warming of the climate in the northern temperate zone led to a rapid shift in the forest character, especially in North America and East Asia. Though the pioneer species of birch, hazel and elm had expanded by the start of the Holocene (Bennett 1983), the vegetation of northern Europe still had a glacial character. In contrast, by the early Holocene the forests of the midsouth United States and eastern Japan were already recognizably modern in species presence, though not in density (Roberts 1998).

Based on early pollen analysis, presumptions were made about the Mesolithic Atlantic forests, suggesting they were dark, impenetrable, and inhospitable to forest animal life, and thus void of humans (e.g. Iversen 1941; 1949; Troels-Smith 1960). These presumptions were primarily based on the waning appearance of herb, grass and other understory species in pollen diagrams from the Atlantic period, giving the impression that early Holocene deciduous forests were solely made of high, dense canopies which drown out penetrating sunlight, making it impossible for understory and forest floor plant species to flourish, and thus limiting the food supply of potential ungulate prey. In contrast, Tansley (1939; 1968) has stated that low-lying vegetation, such as bracken and bramble, are common in modern-day temperate forests and recent work by Barbier et al (2008) suggests that broadleaf deciduous forests provide more diversified vascular understories than coniferous forests. This disparity between the visibility of understory plant species in the pollen record and the actual composition of prehistoric forests is likely the result of the low dispersion rates of understory pollens in comparison to the more dominant canopy trees, as discussed by Rowley-Conwy (1982). As most pollen samples are taken from stratified lake cores, the dispersion of pollen to these lakes directly affects how they are represented within the pollen sample. Work done on the movement of pollen (Andersen 1974; Currier and Kapp 1974; Tauber 1965; 1977) found that wind speed and trunk space restriction within a forest limited the movement of pollen, with pollen from the lower understory and forest floor moving much less than that from the higher forest canopy (Tauber 1977). Additionally, plants that use more complex forms of germination, such as those which are insect-dependant, and forest floor genera such as mosses and herbs, which only diffuse pollen to within a few meters, are unlikely to be detected in a pollen sample (Andersen 1970; Levin and Kerster 1974; Rowley-Conwy 1982).

This discussion makes it clear that while pollen analysis offers a general view of the species and densities of plants within an area, it cannot provide a completely accurate picture. It may be assumed, especially within dense temperate deciduous regions, that the amount of understory, forest floor, and insect-pollinated plants present in early Holocene forests is actually higher than is visible in the pollen record. Rowley-Conwy (1982) has discussed the importance of lime (commonly referred to as linden or basswood where it occurs in eastern North America), an insect-pollinated tree, to the early Holocene Atlantic forests of northern Europe. He has postulated that the high shade-casting quality of lime trees may have resulted in a thinner understory, and thus easier hunting, in areas with a density of lime trees, such as southeast England (Rowley-Conwy 1982: 201). Mellars and Reinhardt (1978) have noted the challenging role of understory vegetation to the efficiency and productivity of hunting in forested areas, noting its hindrance in the mobility and visibility of hunters, as well as the escape cover it offers prey species. They supported these claims with ethnographic examples from deciduous forests in North America where Native Americans have noted that hunting in dense, overgrown understory is particularly difficult and undesirable (Mellars and Reinhardt 1978: 256). The probability that hunting ease and success are directly correlated with the density of deciduous forest understories has significant implications for the use of dogs as hunting tools, and thus the presence or absence of early Holocene dog burials at hunter-gatherer sites. The localities and intensity of the use of dogs as hunting adaptations may be linked to areas of particularly dense understory in deciduous temperate forests. Locations where hunting dog use and intentional dog burials could be expected, based on the forest and prey species types, but are absent, such as England, may correlate to areas of sparse understory, and thus much easier hunting of temperate woodland prey species which do not require the use of advanced risk-minimizing technology such as hunting dogs.

Early Holocene "Complex" Foragers

Many discussions in the 1980's and 1990's about complex hunter-gatherers were spurred by Price and Brown (1985). Arnold (1996: 78) defines *complex* as "those societies possessing social and labor relationships in which leaders have sustained or on-demand control over non-kin labor and social differentiation is hereditary". She argues that complexity is purely a matter of labor relationships, ascribed ranking, and leadership. By this definition then, the forager societies described here should not be termed *complex*, as there is no convincing evidence for ranked social structures or labor division based on ascribed status. To the contrast, there is evidence that these groups were largely transegalitarian with status based on accomplishments in life (i.e. shaman or skilled hunter) and not kinship. Woodman (1985) and Price (1985) suggested there may have been low-level semi-egalitarian organization with temporary tribal leadership accompanying subsistence intensification in Mesolithic southern Scandinavia, but there is no evidence for the sort of status ranking and authoritative power seen in traditionally "complex" groups like the Northwest coast of North America. Arnold (1996) herself identified the shell mound groups of the Archaic midsouth United States, the Mesolithic people of southern Scandinavia, and the Jomon of Japan as similarly grouped when considering the definition of complex given by Brown (1985) : relatively large populations on a circumscribed landscape, temporary leadership, and behaviors which tethered populations to certain lands, such as communal cemeteries. Rowley-Conwy (1983) had already noted how these types of 'complex' foragers fell outside of the mobility models outlined by Binford (1980), as one of their key characteristics is a sedentary, centralized base camp from which they can position themselves to utilize both local and migratory resources.

In response to Lee and De Vore's (1968) outline of the Original Affluent Society (OAS) as a fairly simple plan of uncomplicated society with little personal property, organization, territoriality or food storage, Binford (1980) had created the two-tiered model of 'foragers' and 'collectors' whereby foragers roughly corresponded to Lee and De Vore's description, but collectors moved less often and relied on resource storage and transportation in a 'logistical strategy'. Playing off of Layton's (1986) discussion of alternative strategies taken by the Inuit and Australian Aborigines, Rowley-Conwy (1999) constructed a four-fold typology of hunter gatherers which included: (a) Lee and De Vore (1968) and Binford's (1980) OAS model, (b) logistic groups which do not defend territories, (c) logistic groups which do defend territories, and (d) a fourth categorization of sedentary groups which defend territories and store resources. As Rowley-Conwy (2001) notes, despite Arnold (1996), archaeologists use the term *complex* to describe these non-OAS hunter-gatherer groups. Using the typology devised by Rowley-Conwy (2001), the hunter-gather groups from the Archaic midsouth United States, Mesolithic northern Europe, and Jomon eastern Japan could all be classified as the latter type of complex society – semi-sedentary/sedentary groups which are territorial and store resources.

The Midsouth United States

The Late Upper Pleistocene of the midsouth United States, referred to as the Palaeoindian, is a period which still lacks a great amount of information by which to form a conclusive reconstruction of the palaeoenvironments and lives of human populations. Lakes providing Pleistocene fossil pollen samples are rare in the region, though the existing data suggests that cold-adapted pine, spruce and other conifers dominated the environment in the midsouth after deglaciation began around 14,000 cal B.P. (Meeks and Anderson 2012; Morse, et al. 1996; Walthall 1998). This environment was characterized by low seasonality, long growing seasons, and average temperatures lower than today (Jacobson, et al. 1987; Kelly and Todd 1988; Walthall 1998). Like fossil pollen, Palaeoindian sites in the midsouth are also uncommon, likely due to severe erosion or being deeply buried by hydrographic overhauls, broad scale resculpting of the terrain, and vast movements of Pleistocene sediments (Schuldenrein 1996). Evidence from the few excavated midsouth Palaeoindian sites leave the relationship between Palaeolithic humans and animals unclear, with some researchers favoring a generalist approach to subsistence (Meltzer 1988; Meltzer and Smith 1986), and others who promote a focus on primarily large game (Anderson 1995; Kelly and Todd 1988), such as the mastodon, horse, camel, and giant beaver, which existed in the area (Morse, et al. 1996). While there are clear indications that Late Pleistocene groups were hunting mastodon and other large game, as evidenced by an array of large, fluted points found in association with faunal remains (Morse, et al. 1996), it is apparent that not all Palaeoindian hunters focused on large game. Walker (2007) has noted that Late Pleistocene faunal remains from Dust Cave, Alabama consisted of primarily birds, fish, reptiles and amphibians, with only 17% of the collection representing mammals. Towards the end of the Palaeoindian period and into the Pleistocene-Holocene transition, adaptations to the increasingly warm climate and its associated effects began to manifest in the tool technology used, prey species taken, and increasingly sedentary lifestyles, with the extinction of megafauna and the end of the age of the small, highly-mobile, large game hunting group.

While significant changes to climate and culture began in the early Holocene of the midsouth, in many ways the early Archaic period was a continuation of the late Palaeoindian. In comparison to later in the period, few early Archaic sites are known. Early Holocene warming allowed the temperate deciduous forests to push northwards against retreating ice sheets, with dense oak-hickory forests replaced the boreal forests of the Late Pleistocene (Fiedel 1987; Jacobson, et al. 1987; Roberts 1998; Walker 2002; Walthall 1998). This shift in environments was eventually paired with a shift in prey species, marked by the extinction of megafauna and a move from a focus on the open ecotone migratory species of the Palaeoindian period, to a more broad-based utilization of non-migratory closed habitat resources, including forest ungulates and deciduous tree nuts (Anderson 1995; Jefferies 2009; Smith 1986; Styles and Klippel 1996; Walker 2002; Walthall 1998). A focus on hunting in upland habitats was particularly utilized by early Archaic foragers, with white-tailed deer becoming increasingly important in the early phase and throughout the Archaic as a primary food source (Jefferies 2009; Walthall 1998; Waselkov 1978). This shift to the hunting of medium-sized deciduous forest ungulates in the early Archaic was mirrored in changes to tool technology as well, as shown by the preference for smaller, tapered points after the Pleistocene-Holocene transition (Fiedel 1987). Interestingly, both Chapman (1985) and Anderson and Faught (2000) have observed that bifurcate points specific to the midsouth river valley regions have a very specific extent (c. 400km) that coincides with a specific deciduous forest ecotone (see Chapter 3), which may delimit the range of a specific cultural group or prey species. This is likely related to Schuldenrein's (1996) comment that this region of the midsouth is particularly unique, with highly variable landscapes, ecotones and species communities.

By the middle Archaic a significant shift in environment and lifestyle had taken place in the midsouth. The climate was becoming increasingly warm and dry, with a firm establishment of the oak-hickory-chestnut forests (Delcourt and Delcourt 1979; Gremillion 1996; Jefferies 2009; Wilkins, et al. 1991). Subsistence primarily relied on the hunting of white-tailed deer, supplemented by smaller animals and plant foods (Bader 1992), and increasingly aquatic resources. Sea level rise during this period flooded the river systems of the interior midsouth, creating rich estuaries and encouraging the collection of shellfish and river fish (Fagan 1995; Jefferies 2009). Aggregation of human groups around these static aquatic resources eventually lead to more sedentary habitation and the formation of large shell midden sites. Shell mounds in this region are so large and numerous that this period is often referred to as the Shell Mound Archaic (SMA, see Chapter 3) (Claassen 1996; Jefferies 2009; Marquardt and Watson 2005; Sassaman 2004). The creation of these shell mounds appears to be tied to issues of territoriality, with defense of resources, violent warfare, and prescribed cemeteries. Evidence of violent attacks is apparent in numerous perimortem injuries on skeletons from the region (DiBlasi 1981; Jefferies 2009; Mensforth 2001; Mensforth 2005) and burials, which often include grave goods and red ochre, have been associated with an transegalitarian society, where social position is determined by personal accomplishments while living (Bader and Granger 1989; Lynch 1982; Mayes 1997; Stafford, et al. 2000; Walthall 1998). By the late Archaic the environment was a maximum xeric deciduous forest with subsistence highly dependent on the hunting of white-tailed deer (Styles and Klippel 1996). As populations continued to grow, constraints on resources increased interpersonal violence and territoriality among groups (Kelly and Todd 1988; Schuldenrein 1996; Walthall 1980; 1998).

The transition to agricultural subsistence was gradual in the interior midsouth river valleys. In various parts of the Eastern Woodlands the initial development of horticulture has been documented by 5,000 cal B.P. (Smith 1995), with the minor cultivation of floodplain seeds and weeds, such as chenopods, marsh elder, sunflower and squash occurring by 3,500 cal B.P. in some parts of the eastern and southern United States (Gremillion 1996; Smith 1995), though premaize agricultural systems were not present in the interior midsouth until around 2,000 cal B.P. (Adair 1988; Bellwood 2005; O'Brien and Wood 1998). Unlike the more rapid agricultural transitions in the Old World and Mesoamerica, the expansion of agriculture in the midsouth was much slower. Bellwood (2005) has hypothesized this slow transition is related to the lack of major meat producing herd animals in North America, as well as the lack of a broad spectrum of highly-productive cereals. Though dependence on the hunting of wild game and native cultivation of plants continued well into this agricultural Woodland period of the midsouth, it has been suggested that the eventual shift to agricultural subsistence was a result of increasing population and resource stress, specifically on white-tailed deer in the late Archaic. Growing populations put unsustainable pressure on local forest resources, increasing hunting risk, thus increasing territoriality and violence among the shell mound groups. In an attempt to mitigate these risks and uncertainty, forager groups gradually turned to agricultural subsistence (Bellwood 2005; Flannery 1986; Piperno and Pearsall 1998).

Northern Europe

During the last glacial period the northern latitudes, including southern Scandinavia, were almost completely covered with ice and nearly uninhabited by human groups. Around 14,700 cal B.P. human groups began a re-expansion from glacial refugia, and moved into northern Europe in low population densities (Bocquet-Appel, et al. 2005; Gamble, et al. 2005; 2006; Gamble, et al. 2004). During this period, the Younger Dryas of the late Pleistocene, the vegetation of Europe was highly variable. In the north polar tundra covered large expanses of the northern European region. Due to its high latitude, the vegetation history of this region is significantly delayed in comparison to central and southern Europe (Roberts 1998). Evidence from archaeological sites shows the tundra supported large herds of terrestrial herbivores like horse and reindeer, with many late Pleistocene sites being composed almost exclusively of reindeer remains, indicating this species was a primary resource for hunters in the region

(Aaris-Sørensen, et al. 2007; Eriksen 1996; Roberts 1998). As the climate began to warm towards the Pleistocene-Holocene transition, northern Europe saw a delay in the displacement and disappearance of the arctic species, with reindeer continuing to be of importance even after its disappearance from other parts of Europe (Aaris-Sørensen, et al. 2007; Eriksen 1996). Interestingly, Riede (2011) noted no strong evidence for domesticated dog use in these late glacial reindeer economies, suggesting dogs may not have provided an advantage in reindeer procurement. As the temperate deciduous forests pushed northward into northern Europe these arctic species were replaced by woodland animals such as deer and wild boar (Eriksen 1996; Roberts 1998). Eriksen (1996) has noted that there is an obvious and clear distinction between the cold, late Pleistocene fauna and the warm early Holocene game fauna in the archaeological record and importantly Roberts (1998: 109) has noted “as resources for human exploitation, these animals were more dispersed and less visible in the forests than had been the concentrated and easily-culled fauna of the late-glacial tundra”. With continued climatic warming in the early Holocene, pine and birch boreal forests pushed north into northern Europe and were quickly followed by oak-based Atlantic temperate deciduous forests in the Mesolithic by 8,000 cal B.P. Like the midsouth United States, with these warmer environments came the temperate woodland ungulate species, like deer and boar, which were primary targets for Mesolithic hunters in northern Europe. Magnell (2005) has suggested that the primary hunting apparatus used during the Mesolithic was the bow and microlith arrow, which allowed for shooting at short distances in dense forests. Analysis of these microliths by Friis-Hansen (1990) indicated they were designed to cause maximum tissue damage and massive blood loss in prey, ideal for blood trail tracking by hunting dogs.

In addition to terrestrial resources, rising sea levels, which rose up to 28m by 8,000 cal B.P. in parts of Denmark (Petersen 1981), created highly-productive estuaries and marine coastlines across the Baltic (Krog 1979; Pluet and Pirazzoli 1991; Rowley-Conwy 1983). Again, like the midsouth United States, the reliability and productivity of these aquatic resources drew human groups to the coasts where more permanent settlements began to appear in the middle Mesolithic (Magnell 2005; Rowley-Conwy 1986; Zvelebil and Rowley-Conwy 1986a). These settlements, which were characterized by shell middens, especially in the late Mesolithic (Rowley-Conwy 2011), were formed in locations where several seasonally available resources, such as forest ungulates, shellfish, and deciduous tree nuts, converged within a relatively small area (Rowley-Conwy 1983; 1986). The size and density of these Mesolithic settlements suggested large numbers of humans inhabited adjacent areas near the coasts. While the high productivity rate of plants, shellfish and forest ungulates in the middle Mesolithic would have increased subsistence reliability, it also increased populations and in turn hunting pressure on resources (Rowley-Conwy 1982), as indicated by prey age profiles and a decreasing abundance of taxa through the Mesolithic (Magnell 2005). This increased pressure on resources increased competition, territoriality and violence amongst neighboring groups, as evidenced by violent injuries on skeletal remains from the later Mesolithic periods (e.g. Bailey 2007). While this productive lifestyle allowed Mesolithic hunter-gatherers in the region to avoid the farming that was happening in neighboring regions for about 1,300 years, it is posited that the strain on forest resources, perhaps in combination with a decline in marine productivity around 3,200 BC, may have led to the transition to agricultural subsistence (Rowley-Conwy 1981; Zvelebil and Rowley-Conwy 1986b). Although the Mesolithic groups of northern Europe maintained the hunter-gatherer lifestyle for much longer than central Europe, there was definite contact between these foragers and nearby farmers (Fischer 1982; Zvelebil and Rowley-Conwy 1986b). When agriculture did spread into the region, around 6,000 cal B.P. in Denmark and 5,900 cal B.P. in southern Sweden, the transition was rapid (Rowley-Conwy 2011; Sørensen and Karg 2012).

Eastern Japan

Similarly to the midsouth of the United States, the Late Pleistocene archaeological record of Japan is sparse, due to the low number of habitation sites found, suggesting a high level of mobility, as well as acidic volcanic soils which make preservation difficult on the islands (Barnes 1999; Imamura 1996b; Mizoguchi 2002). During the last glacial maximum the Japanese islands were still linked to each other and the mainland, and continued to be until early Holocene sea level rise separated them (Aikens and Akazawa 1996; Habu 2004). The north-south orientation of the islands means that a range of different climatic and environmental zones exist in each region. In the late Palaeolithic glaciation was limited to the highest summits in Hokkaido and Honshu, with Hokkaido maintaining an arctic environment and boreal forests covering most of the rest of the islands. The exception was a refugium of temperate deciduous forest which existed in the warmest parts of southwest Kyushu (Aikens and Akazawa 1996; Aikens and Higuchi 1982; Akazawa 1986; Barnes 1999). The Pleistocene fossil fauna found from these regions are primarily large mammals, with wooly mammoth and rhino coming from the colder northern regions and bison, giant deer, horse, bear, and elephant being found throughout the main island of Honshu (Aikens and Higuchi 1982; Barnes 1999). While Pleistocene archaeological sites with faunal assemblages are rare, the current evidence suggests Late Pleistocene hunter-gatherers in Japan were targeting these megafauna and large mammals as primary subsistence sources (Barnes 1999).

As the climate began to warm in the early Holocene the overall biotic productivity of the Japanese islands was greatly enhanced, and as Aikens and Akazawa (1996) have noted there were very strong connections between cultural and environmental change across the Pleistocene-Holocene boundary. Temperate deciduous woodlands that had been in refugia in the southernmost parts of the islands began to push their way north into Honshu, bringing the temperate woodland fauna with them. It is clear that by the early Holocene sika deer and wild boar had replaced the boreal and arctic megafauna as the most commonly hunted terrestrial mammals, specifically on the central island of Honshu (Anezaki 2007; Crawford 2011; Habu 2004). With this change in terrestrial hunting came a significant shift in the hunting tools used. In association with the rapidly changing environment and fauna was the first appearance of the microliths on the Japanese archipelago. Like the microliths described from the United States and northern Europe, the Japanese projectile was versatile, easily replaced and designed for cutting deep, bleeding wounds on prey which could be tracked through dense forests by hunting dogs (Barnes 1999; Habu 2004; Mizoguchi 2002). Mizoguchi (2002) has suggested the combination of microblades and bow hunting technology implies a shift in hunting, from large hunting parties taking large mammals in sparse Pleistocene landscapes, to smaller hunting parties taking smaller mammals, like deer and boar, in densely wooded landscapes.

The subsistence shift in central Japan was not solely based on terrestrial fauna. The flourishing of the temperate forests and the finding of stone querns and other nut-grinding tools suggests the Jomon people, like the Archaic and Mesolithic hunter-gatherers, were making use of the deciduous forest nuts, such as acorns, chestnuts and walnuts (Akazawa 1986; Barnes 1999; Habu 2004). In addition to the forest resources, early Holocene sea level rise meant increased aquatic productivity due to low-lying estuaries and extended coastlines, with modern sea levels averaging around 20-30 meters higher than they were at the Pleistocene transition (Iseki 1977), and maximum sea levels occurring around 7,400-5,900 cal B.P. (Habu 2004). As seen in both the midsouth United States and northern Europe, the increase in aquatic productivity encouraged hunter-gatherer groups to congregate at the coastlines around static marine resources. Towards the end of the early Jomon period there was an unprecedented appearance of shellmound sites, specifically in the central-eastern region of Honshu (Akazawa 1986; Barnes 1999; Habu 2004; Koike 1986), with over 60% of the shell middens occurring on the Kanto Plain (Tozawa 1989). The shellmounds were the result of a shift to a sedentary lifestyle by the Jomon, which depended not only on the aquatic productivity of the coastlines, but also on locations which took advantage of a transitional subsistence zone, such as estuary and temperate forest (Akazawa 1986). While shellfish and marine fish were clearly important to the diet of the shellmound foragers, high proportions of deer and wild boar remains from the sites indicate that terrestrial hunting was still the primary form of subsistence (Barnes 1999). While these shell middens started out small in number and size in the early Jomon period, the middle and late Jomon shell middens are characterized by the large size and often horseshoe shape (Aikens and Higuchi 1982; Habu 2004). This increasing size of shell middens in eastern Japan mirrored increasing sedentism and growing populations, which lead to increased hunting risk and pressure on available resources in the transitional subsistence zones (Habu 2004). Aikens and Akazawa (1996) have documented the growing pressure on deer populations through the Jomon period, showing a shift to increasingly younger deer in the later periods, equivalent to the age profiles seen in modern intensively hunted deer populations in Japan (Ohtaishi, et al. 1983). Increasing stress on resources as a result of growing populations is also indicated by the documentation of interpersonal violence present in the Jomon mortuary record (e.g. Kobayashi, et al. 2004).

Like the other regions discussed in this chapter, the spread of agriculture in the specialized forager economy of eastern Japan was resisted. While it is clear that rice agriculture was spread from the mainland, probably the Korean peninsula, it is not clear whether this spread was the result of immigration of people from the mainland and a replacement of the local Jomon populations, the adoption of rice agriculture by the Jomon people, or a mixture of both models (Akazawa 1986; Habu 2004; Hanihara 1985; Kondo 1962; Mizoguchi 2002; Yamaguchi 1982). As seen in the United States and northern Europe, the eventual implementation of agricultural subsistence was likely strongly tied to late Jomon population pressures and resource stresses. Like the spread of the temperate deciduous forests in the early Holocene, the first introduction of rice agriculture in Japan started in southern Kyushu around 2,800 cal B.P. and slowly spread north (Crawford 2011; Habu 2004). While the western Honshu groups, who were already highly dependent on tree nuts and plant cultivation, took up agricultural practices quite readily, there was resistance on the eastern Honshu coasts, where the hunter-gatherer lifestyle was maintained until approximately 100 BC (Akazawa 1986; Habu 2004).

Cross-comparative Analysis

From just this brief discussion of the archaeology and palaeoenvironmental change in the early Holocene, the pattern of similarities is apparent within the three areas analyzed. In each of these regions the climatic and environmental shift that accompanied the Pleistocene-Holocene transition triggered dramatic adaptive changes within the culture. The fact that the environmental change was both rapid and substantial, in terms of effects to the overall lifestyle and subsistence practice of early Holocene groups, was a significant factor in all three areas. Murdock (1967) attempted to find correlations between effective temperature (ET) and subsistence-settlement types, suggesting that those hunter-gatherers who lived in temperate regions would tend to be collectors, in contrast to a more mobile foraging strategy in tropical environments. Sassaman (2004) has noted that it is only within the last few decades that there has been recognition of sedentary, populous hunter-gatherer groups as "complex" societies, with subsistence economies that did not rely on domesticates. Rowley-

Conwy (1983) has discussed the relationship between sedentism and food supply in complex hunter-gatherer groups, suggesting that successful sedentary hunter-gatherers, such as those discussed in the regions throughout this thesis, maintained a home base and seasonally exploited resources which existed within a close range. As Habu (2004) noted in reference to the Jomon, long terms changes in the variety and spatial distribution of available resources would result in long term changes in subsistence-settlement systems. It is clear that for the hunter-gatherer groups living in the northern temperate zone, which saw some of the most significant environmental changes in the world during the Pleistocene-Holocene transition, there would have been a considerable amount of adaptation needed to adjust to the new, warmer, forested environment and its fauna.

In the subsequent chapters of this thesis, which further detail the archaeology and environmental changes which accompanied the transition in to the early Holocene, a clear pattern of parallel adaptations within the three regions is presented. While many researchers have identified these groups as complex foragers with broadly similar environmental settings and cultural traits, there has not been a comprehensive assessment of how these similarities were manifested behaviorally in terms of hunting adaptations. Whereas it has been recognized that the early Holocene climatic and environmental drivers affecting the subsistence economies of these groups are nearly identical, possible parallels in the way they adapted their hunting strategies to deal with these new conditions have gone unexplored. One of these parallels in the use of dogs as a significant part of a closed forest hunting method, a vital tool which allowed hunters adapt to the changing environment and prey species while minimizing hunting risk and maximizing hunting returns. This thesis hypothesizes that the large clusters of intentional, individual dog burials observed in each of the three regions, which began simultaneously after the Pleistocene-Holocene transition, are the result of an increased valuation of the dog as a crucial hunting weapon and respected member of the group, as is seen in modern hunting groups (see Chapter 7). Independently, these dog burials are known as defining archaeological characteristics in parts of the Archaic midsouth United States, the Mesolithic northern Europe and Jomon eastern Japan. However, the possibility that these contemporaneous occurrences could indicate similar adaptations in hunter-gatherer groups on a worldwide scale in response to global climate change has yet to be considered.

Chapter 3: Typology of Archaeological Dog Deposition

Introduction

Dogs (*Canis familiaris*) are the first known domesticated animal and their remains are commonly found among archaeological sites around the world from about 15,000 years ago (Larson, et al. 2012). Though occasionally considered a subsistence animal by various cultures (Pferd 1987; Schwartz 1997; Webb 1946), the dog has more generally been treated as an animal of social distinction, with the liminal position of 'neither person, nor beast' across many cultural groups. Given this social relationship with humans, it is curious that the deposition of dogs has not been afforded more attention in the archaeological literature. In contrast to the burial of humans at archaeological sites, the deposition of dogs has received only minor consideration. Due to the variety of roles dogs have played in the past the interpretation of their remains can be challenging (Morey and Wiant 1992a; Olsen 2000). As the dog's social position varies, so too does its deposition in the archaeological record. While a great many archaeological sites contain miscellaneous dog remains that appear to be the result of disposal to avoid the more unpleasant attributes of a decomposing carcass, other remains appear to represent careful, intentional depositions that may be the result of a much more complicated social relationship between human and animal (Clark 1996; Losey, et al. 2011). With such a wide range of plausible interpretations of archaeological dog remains, how is it possible to determine the most appropriate interpretation of a *particular* dog deposition?

The dogs' flexible social position is an important aspect when considering their past mortuary treatment. In some groups their status may have been as a *pariah* and as such their disposal was not particularly notable. In the Nuaulu culture of eastern Indonesia, dogs which are of no practical use or have problematic behavior are killed and disposed of without ceremony in nearby bush or a dry riverbed (Ellen 1999). Dogs may also have been treated as *food* as demonstrated by the ethnographies and butchery evidence of many proto-historic Native American tribes (Pferd 1987). Textual evidence states that as a demonstration of *sacrifice,* the Hittite 'Ritual of Huwarlu' called for a puppy to be killed to protect the king and queen from evil (Collins 1990) and in some modern aboriginal groups dogs are accorded intentional burials, sometimes with gifts, in return for their role as a valuable hunting *partner* (Nobayashi 2006). Similarly, throughout the modern world, dogs are regularly buried as a treasured *companion*. Given these examples, one can assume there was rarely just one type of relationship between dogs and humans in any given society in the past (Hamilton 2000; Parmalee, et al. 1972; Serpell 1995). Dogs could have simultaneously occupied all these roles within a single group and it is likely that such varying functions are reflected in the differing modes of deposition.

This chapter is concerned with identifying the physical characteristics present in the different modes of archaeological dog deposition, in order to create a comparative methodology by which to interpret the remains. Only through the development of *context-specific* interpretations of archaeological dog deposition will we be able to obtain a more precise and in-depth picture of the varying relationships between dogs and humans in the past. The initial step towards achieving this is to step back from interpretation and first conduct a far more thorough analysis of the variability of dog deposition than has been previously carried out. As noted by Morris (2011: 168) separating the description from the interpretation of these deposits is often difficult but we must try to isolate the *how* from the *why*. By considering the description and interpretation as separate processes, we can build the taphonomic history of a deposit, which can then form a foundation to develop ideas about the *why* of the human actions behind it. This chapter aims to provide a typology of dog deposition in archaeological contexts, for the first time, which will enable such an analysis to be undertaken, utilizing this wealth of information to better understand the nature of past human-dog relationships.

Developing a Typology of Dog Deposition in Archaeological Contexts

Why is it necessary?

A lack of common vocabulary within the archaeological literature on dog mortuary treatment, particularly discrepancies by what is meant by the term *dog burial*, has led to widely varying interpretations of archaeological dog remains. The 'special' deposition of dogs, especially when co-deposited with humans, has been interpreted in a many different ways, including: a valuable companion (Jennbert 2003) or household member (Fahlander 2008), a cenotaph (Larsson 1990a), a shaman (Strassburg 2000), symbolic protection (Munt and Meiklejohn 2007), and a foundation offering (Olsen 2000). It could be said that there are as many interpretations of dog deposition as there are depositions themselves. Given this, the utilization of a uniform terminology seems overdue. As seen in human mortuary contexts, the creation of a deposition typology may be the most effective method for systematically classifying and in turn interpreting the dog deposition record. Although some take a cautious approach in avoiding cross-cultural comparisons (Hill 1996), the best solution may be identifying the physical characteristics of dog deposition, encouraging individual interpretations within context, and establishing a criterion by which to discuss those interpretations. Such systematic treatment of archaeological dog remains can help in decoupling our modern preconceptions of the relationship between humans and dogs from the archaeological record (Brück 1999), and assist in understanding the context-specific human constructs behind the different modes of dog deposition present in the record. In addition, a typology will enable identification of dog deposition patterns across time and regions. Overall, the universal adoption of a typology for understanding dog deposition in archaeological contexts should lead to the development of a more in-depth understanding of early human-dog interactions.

Ambiguity of the 'dog burial'

One of the most problematic terms used in the current literature when describing dog deposition is the phrase *dog burial.* Unlike any other animal, the dog often held a significant social position (as guardian, hunter, herder, and/or companion) in many human cultures. As such, it is not unreasonable to suggest that the deposition of dogs in some instances exemplified this more intimate association, even mirroring the deposition of humans in several cases (Larsson 1990a; Morey and Wiant 1992a). Yet, particular attention has rarely been paid to the range of characteristics present in deposition of dogs within the archaeological record. Some are deposited alone with elaborate grave goods or coburied with humans, while others are represented by a single element, such as a mandible, placed in a human grave. Still others are whole or partial remains found within rubbish pits or middens. All of these deposition types have been commonly referred to as *dog burials*. The lack of a more developed terminology has led to complete, articulated remains being discussed and interpreted comparably to a fragment dog element found within refuse. The problem this creates is best described by Morris (2012: 8):

> *Although at first it may appear unimportant, the terminology and language used by archaeologists describing a deposit can greatly influence its interpretation, and importantly, the concepts of other archaeologists. Terms such as 'special', to many archaeologists, automatically implies a ritual connotation, similarly 'burial', a term utilized mainly for human remains, may conjure images of a ceremonial/ritual event*

As demonstrated by the diverse conclusions of different researchers, there has been no common agreement as to what should be termed a *dog burial*; instead the term has been used to describe a wide range of deposition types. At the Mesolithic Skateholm site in southern Sweden, several complete dogs were found interred individually, some with elaborate grave goods, and have been interpreted as dog burials (Larsson 1990b). Numerous dogs, some partially complete and some represented by only a few elements, were excavated from the Eneolithic Botai site in Kazakhstan where they had been regularly deposited under floors, in wall pits or to the west of building entrances. These too have been referred to as dog burials in the literature (Olsen 2000). From Natufian Israel, two dogs interred with human remains are reported as dog burials from the site of Hayonim Terrace (Tchernov and Valla 1997) and from the Upper Palaeolithic German site of Bonn-Oberkassel, a much-debated isolated canid mandible fragment has also been cited as a dog burial (Morey 2006). In the few literary instances where various archaeological dog depositions have been collectively discussed, these and similar examples have been referred to as forming the corpus of a *dog burial record* (Crockford 2009; Miklósi 2008; Morey 2010). However, when assessed individually, the problem with this terminology becomes clear. The fault lies not with the researchers, but with the absence of a more developed vocabulary by which to distinguish these different modes of deposition from one another. This lack of a developed terminology, along with the implications behind the term *dog burial*, not only affects the way in which individual dog depositions can be discussed and compared, but also colors the concepts and interpretations of other researchers. A more synthesized terminology for dog deposition will aid in a deeper understanding of the very earliest processes and interactions between dogs and humans.

The Typology

As shown through previous examples, the range of dog deposition types encountered at archaeological sites is as variable as those of human remains. And like human mortuary practices, the form and structure which characterizes dog deposition is likely to be conditioned by the form and complexity of the society in which they were part (Binford 1971). The purpose of this typology is not the interpretation of these dog depositions, but the creation of a functional language by which to interpret the remains within their individual cultural contexts. While common factors may influence the social dimensions of dog deposition across cultural contexts, these factors are abstract and their archaeological application will vary in each case considered. Thus, this typology should not be taken as a guide for archaeological interpretation, but rather as a starting point from which to derive interpretive principles appropriate for each individual case (Tainter 1978).

For the purpose of the typology, the examination of dog depositional data has been carried out on two levels. The first level involves the identification of individual variables observed in the depositions. These variables are manifest in every mode of dog deposition, even if only in the form of absence (Adams and Adams 1991). Four such variables are identified for application to the dog deposition record: *physical traits*, *location*, *grave goods*, and *similarity to human deposition*. As these variables are qualitative, the flexibility offered allows for interpretation within individual cultural contexts. Within each variable, a set of observed possible characteristics has been defined. An examination of the current archaeological dog deposition record shows a marked correlation among sets of these characteristics, leading to the identification of five distinct depositional types: *isolated*, *associated*, *component, elemental*, and *expedient*.

Characteristics of the Typology

Physical Traits

Articulation and Positioning

Though often encountered in the archaeological record, the deposition of fully and partially articulated animal remains has rarely merited explanation, until recently (Morris 2010; Pluskowski 2012). This is primarily due to the fact that animal bones were commonly considered of a purely economic origin (Hill 1995). This has been a particularly problematic assumption for domesticates outside of the conventional subsistence sphere, such as the dog, and arguments have been made for a more rigorous examination of these deposits (Luff and Moreno-García 1995; Maltby 1985; Morris 2011; Olsen 2000; Pluskowski 2012; Wilson 1992).

Grant (1984), working within Iron Age contexts, defined *special animal deposits* as depositions which consisted of three types: *animal burials*, *skulls (including mandibles)*, and *articulated legs*. However, she also included a number of individual bones in her classification. She suggested that both *animal burials* and *articulated legs* consisted of more than one element found in articulation at the time of excavation. Not convinced by the word 'special' Hill (1995), in his examination of 'ritual and rubbish' in the Iron Age, adhered to Grant's types, but renamed them *associated animal bone groups (ABGs)*, a term that has become popular for general referencing of articulated animal remains (Broderick 2012; Morris 2010; Pluskowski 2012). Morris (2011) has redefined *ABGs* for his own purposes as those animal remains which a) have been deposited with attached flesh or connective tissue, causing them to remain articulated, b) are disarticulated through some taphonomic process, but have been identified as a single animal which was likely previously articulated, c) are disarticulated when deposited, but associated and constitute the remains of a single animal. Therefore, he does not include single bone deposits, including isolated skulls and mandibles, in his definition.

For the purposes of this typology *associated animal bone groups* as they relate to dog deposition will include those remains as defined by Morris (2011), as well as articulated limbs and individual bone elements, such as skulls, mandibles, and teeth, when found in association with human remains. *Fully articulated* dog remains (Fig. 3.1) are those which appear to have the majority of the elements present and in correct anatomical position. Cases where the remains are complete save for a missing element or two should be considered complete if the missing elements appear to be the result of a taphonomic issue or other post-depositional disturbance. *Partially articulated* remains (Fig. 3.1) are those which appear to be in the correct anatomical position, but only have a portion of the articulated elements present. In the case of partial articulation, the missing skeletal elements do not appear to be a result of obvious taphonomic or disturbance issues, but are an intentional partial deposition. This category should be applied to those animals which have been deposited complete, save for the skull, as well as individual articulated portions of the dog, such as articulated limbs. Remains with *no articulation* are comprised of a single element only, most often consisting of a skull, mandible, or individual teeth.

Figure 3.1. Full articulation from an Iron Age site in Kent, UK (left; photograph: Wessex Archaeology) and partial articulation from a Woodland-period site in Tennessee, USA (right; photograph: Frank H. McClung Museum)

In addition to articulation, the way that a dog's body is manipulated and orientated, especially in relation to treatment of human and other animal remains at the same site, may be an important indicator of their social position in life (Parker Pearson 1999). While a wide range of body positioning is commonly observed in human mortuary treatment, the positioning of dog remains is less variable. The most common distinction seen is between positioning which is intentional and an absence of positioning all together. *Placed positioning* (Fig. 3.2) is the intentional placement of dog remains as identified by a deliberate positioning of the body on one side in an extended or curled position. The head is often placed straight out from the body or curled inwards. A long tail is generally intentionally curled around the backside and placed between the legs and the feet are often placed with paws gathered together or tucked under the body. The term *haphazard* has been borrowed from human mortuary terminology, where it is used to describe the obvious throwing of the body into a pit, midden, trench or other location (Sprague 2005; Fig. 3.2). Remains with haphazard positioning are those which appear to be lacking any intentional placement. They are commonly found in twisted, piled or otherwise indiscriminant positions. The heads are often bent backwards with limbs and tails askew. In addition to articulation and position, the cardinal orientation, alignment at which the body is facing, and the side on which the dog has been placed should be noted as these traits are often repeated and may aid in the interpretation of the deposition (Crockford 2009).

Figure 3.2. Placed positioning from Middle Jomon Fujiwara Kannondo shell midden, Chiba Prefecture, Japan (left; photograph: Kobayashi, et al. 2004) and haphazard positioning from a Bronze Age site in Cambridge, UK (right; photograph: Cambridgeshire County Council)

Trauma and Pathology

Evidence of physical *trauma and pathology* either in life, perimortem, or as post-mortem behavior (e.g. butchery) is common in archaeological dog remains and can be important in the interpretation of the relationship between human and dog. Trauma and pathology are here defined as indications of injury, disease, and/or age-related stress observed on skeletal remains. Trauma and pathologies on dog remains are observed in various forms including those which appear to be human-inflicted (butchery, skinning marks), pathological (arthritis, dental caries) or indeterminate (broken limbs, healed wounds) (Fig 3.3). Common traumas and pathologies sustained during life include extensive bone pathologies, which may suggest an element of care had been provided. A small canine from a Roman cemetery in Tunisia was found to have severe trauma to the skeleton, including widespread arthritis and advanced tooth loss. Its age was estimated to be somewhere between 15-18 years and it is suggested the animal would have needed great care from humans to have survived with such an extensive suite of disabilities (MacKinnon and Belanger 2006). Perimortem injuries include fatal cut marks (e.g. the cutting of the throat) and severe, unhealed wounds or breakages which point to cause of death. At the Bronze Age site of Százhalombatta-Földvár in Hungary, a location of apparent dog consumption, numerous dog crania were found with severe blows to the frontal bone, a likely mode of dispatch (Vretemark and Sten 2010). Post-mortem traumas are seen in the form of butchery cut marks, skull damage for brain removal or flay marks from skinning, as seen on a high percentage of dog remains from sites in Iron Age Greece, where dogs had been skinned before being butchered (Snyder and Klippel 2003; Fig. 3.3).

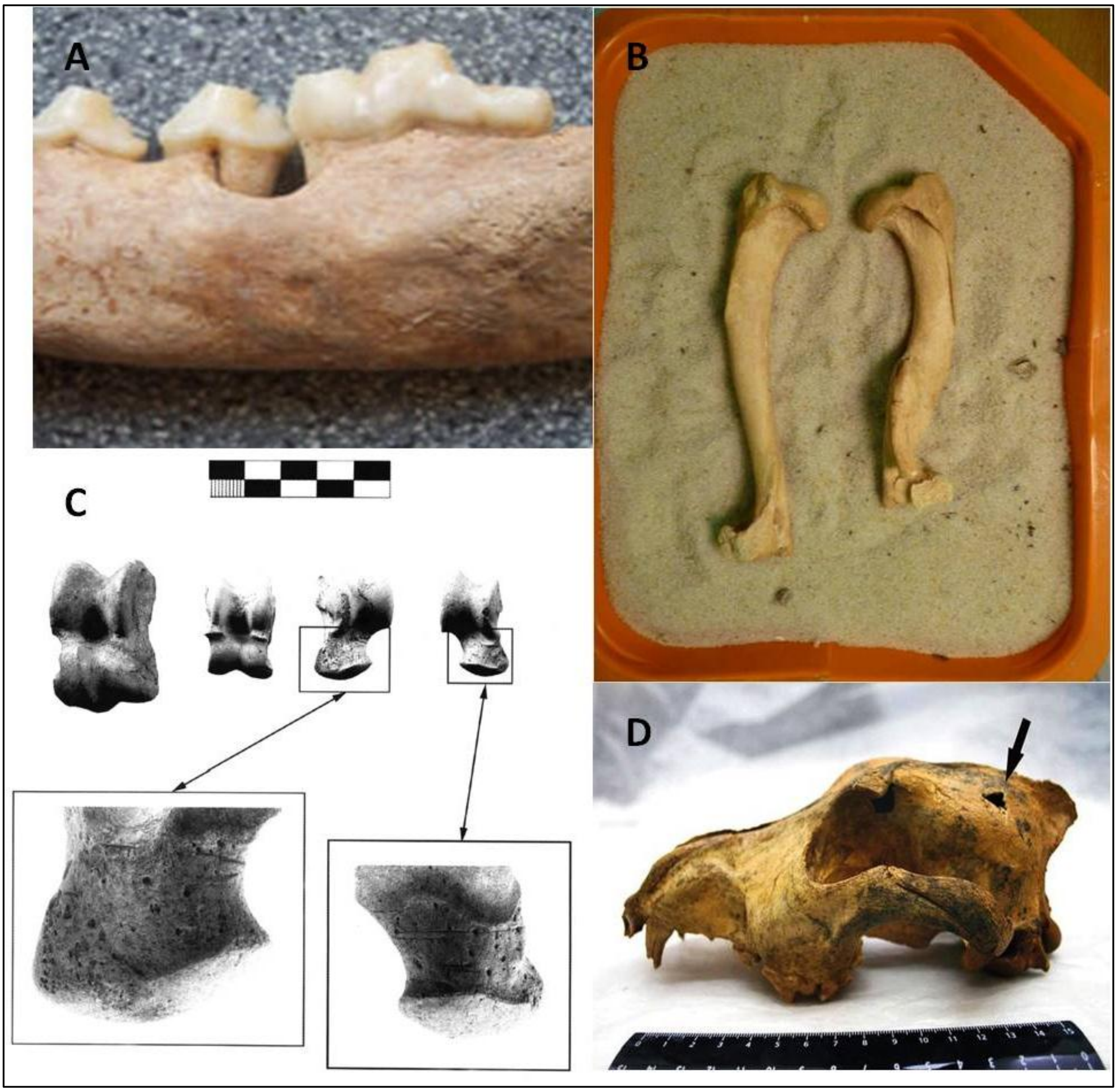


Figure 3.3. Trauma and pathologies to archaeological dog depositions including; a) tooth abscesses (Iron Age Love's Farm site, UK; photograph: Ian Baxter), b) broken and healed limbs (Archaic Modoc Rock Shelter site, USA; photograph: Angela Perri), c) butchery and skinning marks (Iron Age Kastro site, Crete; photograph: Snyder and Klippel 1997), d) cranial blows (Palaeolithic Razboinichya Cave site, Siberia; photograph: Ovodov, et al. 2011)

Age, sex, and size

While the age, sex, and size of dogs found in archaeological contexts can sometimes be difficult to assess, especially in the case of partial remains or individual elements, there is evidence that these factors may have played a significant role in the relationship between dogs and humans in various cultures. Dogs of certain ages are known to have been preferred by particular groups in the carrying out of ritual and other symbolic practices. Written sources from the Hittite culture impart that the sacrifice of puppies played a vital role in the carrying out of prevention and purification rituals, to the exclusion of adult dogs (Collins 1990), while modern ethnography in lowland Nicaragua suggests male dogs may play a greater role in hunting success and thus have a greater value to the society (Koster and Tankersley 2012).

Location

As observed in human mortuary treatment, the placement of dog remains, both the specific location and the spatial distribution, is one of the most visible activities through which a society can express the relationship between dog and human. While mobile hunter-gatherers may have practiced expedient disposal such as abandonment or shallow deposition due to their highly mobile nature, *special-place disposal* or *cemeteries* were more common among those groups who practiced long-term occupation of a restricted territory and among most sedentary communities throughout history (Walthall 1999). In groups that had close social relationships with dogs, the placement of their remains may have been less a function of expediency and more imbued with significance, consistent with the special mortuary treatment of human remains. In other communities the locality and distribution of dog remains may mirror the deposition patterns for other domestic subsistence animals, such as cattle or swine, suggesting a more secular role of the dog.

The *deposition settings* (the physical location in or on which the individual skeletal remains are located) observed in dog disposal in archaeological contexts are quite variable, showing great disparity between geographic locations and cultures. The concentrated deposition of dogs is common in the early Holocene shell middens of Japan (Shigehara and Hongo 2000), USA (Morey 2006), and northern Europe (Larsson and Lundmark 1989). The remains of dogs are also found in constructed pits, both those meant as graves, as well as those which were originally created for another purpose (Cole and Koerper 2002; Morris 2011). In Iron Age England, the remains of complete and partial dogs were commonly disposed of in ditches or abandoned storage pits (Hill 1996) and they have been found in a well in ancient Sicily (Chilardi 2006) and kivas in the North American Southwest (Hill 2000), among other places. The deposition of dogs within building foundation walls or pits is also a fairly common discovery, as described from Dorchester, Roman Britain (Woodward and Woodward 2004). In addition to these depositions found directly in the ground, dogs are also found deposited within various containers including pots (Fig. 3.4), mugs, and urns (Daróczi-Szabó 2010), coffins (Tooley 1988), and ships (Sikora 2003).

Figure 3.4. A dog deposition in a pot from Roman Netherlands (photograph: Groot 2009)

While many dogs have been found deposited alone, there is a frequent pattern of *co-deposition* in dog mortuary treatment, both with humans and with other animals. Likely due to their close domestic relationship, the dog is one of the most common animals found interred with humans. These co-depositions are found in various stages of articulation from fully articulated dog skeletons to individual elements like mandibles and skulls. At the site of Ein Mallaha from Natufian Israel, the skeleton of a puppy was found curled next to the remains of a woman (Davis and Valla 1978), while the remains of two dogs were found associated with six humans in a "mass grave" at the Archaic site of Braden in the USA (Yohe and Pavesic 2000). At the Mesolithic sites of Lepenski Vir and Vlasac on the Danube Gorge, multiple humans have been interred with individual dog mandibles (Radovanović 1999) and a unique "death pit" from Neolithic Turkey includes highly fragmented human and dog elements, along with those from other animals (Kansa, et al. 2009). Along with these human-dog co-depositions, dogs are also frequently found deposited with other animals, including other dogs. Two dogs from 13th-14th century AD California were carefully interred together with associated grave goods (Vellanoweth, et al. 2008; Fig. 3.5), while a pit full of articulated dogs remains was excavated from Iron Age Crete (Day 1984). The deposition of dogs with other animals, both domestic and wild, is a widespread phenomenon as seen from Neolithic, Bronze Age (Morris 2011) and Iron Age England (Wilson 1999), Copper Age Hungary (Horváth 2012), and Roman Netherlands (Groot 2012).

Figure 3.5. Two dogs from the Channel Islands, California, USA deposited with a variety of grave goods (photograph: Vellanoweth, et al. 2008)

It is generally acknowledged that the identification of corporate group differentiation by means of spatial distribution is a valid criterion in the use of mortuary data for the reconstruction of social organization (Parker Pearson 1999; Tainter 1978). Therefore, the examination of the spatial distribution of dog deposition at a site may provide insight into the social relationship between humans and dogs within individual contexts. Following the definition of *cemetery* described in human contexts, a 'dog cemetery' would include: a reasonable number of depositions, depositions which are contiguous and patterned, an area with a geographical or cultural boundary, and a site which had not been used as a living area during the period when dogs were being deposited (Pardoe 1988). Clustered depositions of dog remains which closely mirror the deposition of humans are not only seen from modern dog cemeteries in the USA (www.petcem.com, www.coondogcemetery.com), Asia (Chalfen 2003; Kenney 2004), and Europe (Howell 2002; Kete 1994), but are observed in archaeological contexts as well. The complete dog depositions from the previously described Skateholm site in Sweden were found buried individually, and clustered together at the edge of the human cemetery area (Larsson 1990b; Fig. 3.6). Similar cemetery-like groupings are seen from Archaic sites in the USA (Faulkner and Graham 1966; Magennis 1977).

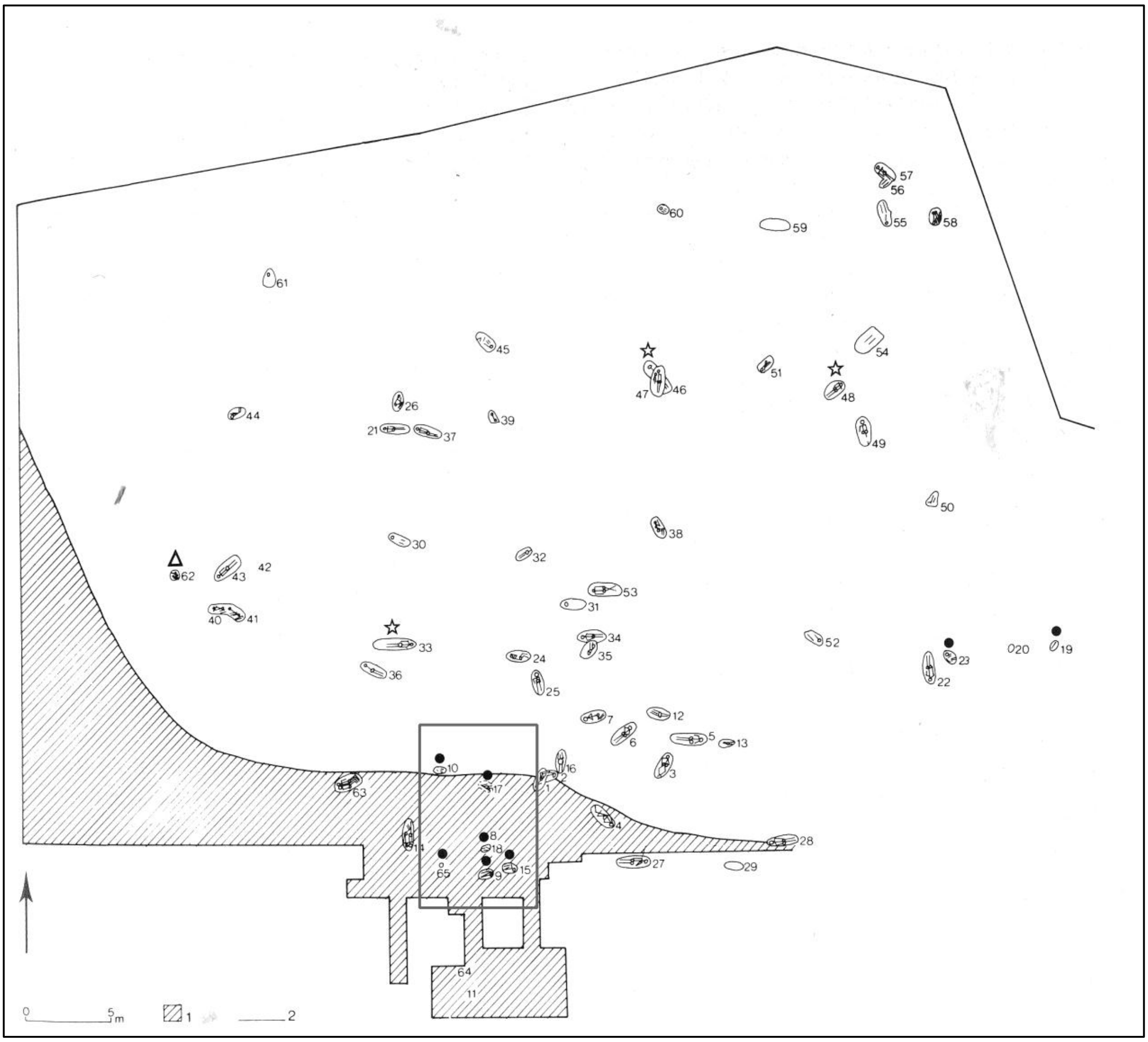


Figure 3.6. Plan of the Skateholm site with isolated dog burials (black dots) placed in the 'dog cemetery' (highlighted; Larsson 1990b)

Grave Goods

As noted by Clarke (1975: 52) *grave goods* "may be defined as everything within a grave that was intentionally deposited, but that did not form part of the body, the means used to convey the body to the grave or the grave-structure itself." Importantly, here *grave goods* is used to describe those items not only found *in* a deposition, but also *on* a deposition, such as rocks, monuments, or other markers. Across geographic locations and time periods dogs have been discovered deposited with a variety of grave goods. The discovery of grave goods with dogs interred alone is particularly notable in comparison to grave goods found with human-dog co-depositions as in the case of a dog-only deposition the grave goods can be more closely associated to the dog itself. At an Archaic site in Missouri USA, a dog was found deposited alone in a small pit covered with a tumulus of limestone rocks (McMillan 1970), while during the same time period in nearby Alabama another dog was found deposited alone with a heavy layer of shell piled over the interment (Webb 1938). At the Tollifero site in Virginia USA, an individual dog was curled and deposited upon a crude stone pavement and dogs have been found deposited beneath stone slabs at other archaeological sites (DeJarnette and Wimberly 1942; Kerber 1997). In addition to these more conspicuous markers, traces of red ochre have frequently been found covering individual dog depositions as well (Brizinski and Savage 1983; Cantwell 1980; Gunn, et al. 2010; Larsson 1990a).

Dogs are also found deposited with more elaborate grave goods, often on par with the grave goods normally found associated with human burials (Fig. 3.7). At Koster, the site of one of the oldest known individual dog depositions in the Americas, a dog was interred with a mano and metate in close association (Morey and Wiant 1992a) and a dog from the Skateholm site in Sweden was interred with flint flakes, a red deer antler, and an ornate stone hammer (Larsson 1990b). Other dogs interred individually from the USA have been deposited with bone awls (Lewis and Lewis 1961), pottery sherds (Miller, et al. 1962), complete ceramic pottery (Epstein 2010; Fitzgerald 2009), faunal elements from small mammals (Bentz 1988), and projectile points (Walker and Morey 2005). Two dogs buried together in the Channel Islands of California were found interred with several items made of materials not native to the island including a sandstone bowl, morning glory (*Convolvulaceae* family) and wild cucumber (*Marah macrocarpus*) seeds, and a splintered redwood (*Sequoia sempervirens*) fragment (Fig. 3.5; Vellanoweth, et al. 2008).

Figure 3.7. A dog deposition from an Iron Age site in Ban Non Wat, Thailand deposited with grave goods including pottery (photograph: Nigel Chang)

Similarity to Human Deposition

It is often argued that the nature of 'personhood' in life is reflected in mortuary treatment (Gillespie 2001; Parker Pearson 1999) and that this ascribed theory can be applied to the mortuary treatment of dogs as well, given their traditionally close social relationship with humans (Hill 2000; Morey 2006). When possible the characteristics of dog deposition should be considered in relation to the deposition of human remains at the same site. This comparison can facilitate an understanding of the nature of the dog deposition within the context of the associated communities of the living and the dead (Flores 1999).

Similarities between human and dog deposition have been noted throughout the archaeological record. In Australia, dog remains have been found wrapped in paperbark and placed within rockshelter clefts, mirroring the mortuary treatment provided for human remains and suggesting a level of preferential treatment over other animals (Gunn, et al. 2010; Mulvaney 1996; Fig. 3.8). Miller (1962: 243) has noted that the individually deposited dog remains from the Tollifero site in Virginia, USA "were as carefully interred as those of the humans" while Webb, Haag, and DeJarnette have repeatedly noted parallels between human and dog mortuary treatment from the Archaic mid-south USA (Webb 1950b; Webb and DeJarnette 1942; 1948a; Webb and Haag 1940b; 1947) stating, "It appears that many dogs were buried with the same degree of attention to grave pits and placement of body as was accorded to their human contemporaries" (Webb and Haag 1939: 155) and "dogs were often buried with the same care as that given to human burials" (Webb 1950b: 272). Archaeologists in Wisconsin, USA have made similar comparisons for Woodland-period human and dog remains, suggesting that not only are the physical characteristics of the mortuary treatment comparable, but isotopic analysis also shows they shared a similar diet as well (Epstein 2010). At one site in Wisconsin where a dog had been bundled and interred identically to a human, it is proposed that the treatment of the dog had gone beyond what was expected for a sacrifice and must be the result of an attributed status within the group (Van Langen and Kehoe 1971).

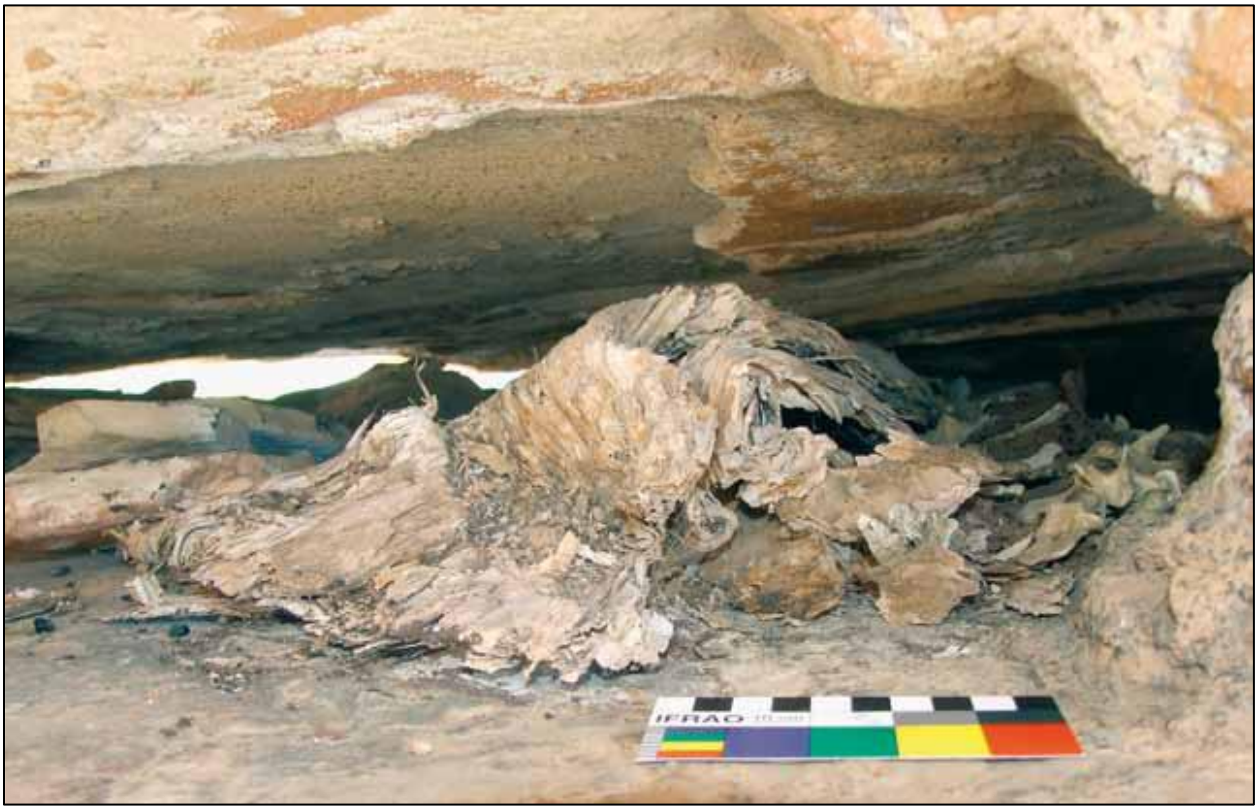


Figure 3.8. A dingo deposition from Australia wrapped in paperbark similar to nearby human burials (photograph: Gunn, et al. 2010)

While it is clearly a popular suggestion that parallels between human and dog mortuary treatment are evidence of a dog's elevated status within the group, some researchers instead suggest that individually interred dogs, especially those found with grave goods, are *cenotaphs* or symbolic substitutes for a missing human occupant. At the Skateholm site where a handful of dogs have been individually deposited, including one with the richest grave goods of any dog or human, it is suggested that dogs likely represent surrogates for their human masters (Larsson and Lundmark 1989). Other researchers note that the propensity for male dog depositions, paired with evidence for raiding and violence at sites from the Archaic mid-south USA, may mean dogs acted as stand-ins for victims that were irretrievable. However, this hypothesis is questionable as sites with dozens of individual dog depositions this would equate to massive losses to the community (Claassen 2008).

Depositional Types

Researchers have always found the interpretation of dog depositions to be problematic (Hill 1995; Mazzorin and Minniti 2006; Russell 2012; Savioz 2012; Wilson 1992). Although previous efforts have been made to distinguish between the different modes of dog deposition, the analyses rarely venture beyond ritual vs. economic. Terms such as *special, sacrifice,* and *burial* are often used to describe those deposition which are articulated and associated with some sort of grave goods, while everything else is usually assumed to serve some more mundane function (Grant 1984). It is rare for any of the descriptive terms used to be defined in these cases. Hill (1995) has highlighted the need to examine the agency involved in different types of *associated bone groups* (ABGs) which led Morris (2010) to divide them into the categories *ritual*, *functional*, *mixed* and *unknown*. Pluskowski (2012) has stressed a further need for documentation and publication of ABGs, noting that such deposits need to be viewed as human constructs. The dog's variable social role and liminal position between human and animal makes this interpretation particularly challenging, especially without an established classification of deposition types observed across the archaeological record. The depositional types presented here are the result of an extensive examination of the archaeological literature, but cannot be exhaustive. The types are characterized by the recurrence of similar sets of the above described characteristics. It is proposed that through the identification of these patterns interpretation of the remains will be advanced on both an individual site and cross-cultural basis. The following discussion of depositional types and their associated characteristics has been summarized in Table 3.1.

Characteristics Types	Articulation and Positioning	Trauma and Pathologies	Age/Sex/Size	Location	Grave Goods	Similarity to Human Deposition
1. Isolated	Full articulation (possibly partial if disturbed); placed positioning	No perimortem or postmortem trauma, possible trauma during life	Variable	No co-deposition, burial pit common, possible 'dog cemetery'	Possible	Usually closely mirror human burials at same site
2. Associated	Full or partial articulation; placed positioning	Possible trauma from life, perimortem, and postmortem	Variable	Always co-deposition with human burial	None associated with dog	Not applicable
3. Component	Full articulation (possibly partial if disturbed); placed positioning	Possible trauma from life, perimortem, and postmortem	Variable	Possible co-deposition with humans/other animals; deposition pit common	Possible	Possibly similar in 'ritual' contexts
4. Elemental	No articulation; no positioning	Possible trauma from life, perimortem, and postmortem	Variable	Always co-deposition with human burial	None associated with dog	Possibly similar though uncommon
5. Expedient	Full, partial, or no articulation; haphazard positioning	Possible trauma from life, perimortem, and postmortem	Variable	Possible deposition pit, but convenient disposal location more common	No	Possibly similar though uncommon

Table 3.1. A typology of dog deposition in archaeological contexts

Primary

An *isolated* deposition displays full articulation, except in the case of obvious taphonomic or post-depositional disturbances where the remains are left with partial articulation. The deposition is always in a placed positioning, often with the paws gathered together and tail curled under the body, with a clear level of attention paid before the covering of the body. There is a complete absence of any perimortem or postmortem trauma suggesting that the dog was butchered, skinned, sacrificed, or killed by a human in any other way. Trauma and pathologies sustained during life such as healed broken limbs and bone pathologies may be present. The age, sex, and size of the animal are all variable and may span any possible category, though isolated depositions are much more common among dogs over two years of age. While isolated depositions are found in different locations at different sites, they may also be found in clustered 'dog cemeteries' near other isolated dog depositions.

One of the key identifying features of the isolated deposition is the absence of any co-deposition. Isolated depositions are dogs which have been placed alone, without a human or another animal. They are commonly found in deposition pits, layered shell middens, or other preparations that closely mirror the burials of humans at the same site. Like many human depositions, these isolated depositions often incorporate grave goods, including red ochre and grave markers. An isolated deposition is what I propose should be termed a true *dog burial*. This depositional type involves the level of care and attention generally afforded to human burials and most importantly gives the appearance that the significance assigned to the deposition is beyond what is typically provided to a non-human animal.

One of the best examples of isolated deposition comes from the previously mentioned Skateholm site in Sweden. Here several dogs display isolated deposition, with individual deposition pits and a lack of perimortem or postmortem trauma, including one which was buried with abundant grave goods (Larsson 1990b; Fig. 3.9). Similar carefully placed isolated dog burials are seen from the Archaic shell middens of the mid-south USA at the Perry site (42 primary depositions; Webb and DeJarnette 1942), the Carlson Annis site (25 primary depositions; Webb 1950a), the Read site (23 primary depositions; Webb 1950b), and the Indian Knoll site (11 primary depositions; Webb 1946; Fig. 3.10) among others. These isolated depositions are seen in various places around the world, including Europe (Brinch Petersen and Meiklejohn 2003; Kooijmans 2003; Larsson 1990b), the USA (Breitburg 1983; Dowd and Breitburg 1989; Kerber 1997), Asia (Hasebe 1952b; Shigehara and Hongo 2000), and Australia (Gunn, et al. 2010).

Figure 3.9. An isolated dog burial from the Skateholm site, Sweden (photograph: Larsson and Lundmark 1989)

Figure 3.10. An isolated dog burial from the Indian Knoll site, Kentucky, USA (photograph: Frank H. McClung Museum, WPA/TVA Archive)

Associated

Associated depositions are specifically categorized by the inclusion of a dog or dogs in the burial of humans. The remains of the dog(s) are in full or partial articulation and the positioning is quite often placed, though haphazard positioning is also possible. The remains may show evidence of butchery, decapitation, skinning and other trauma, both pre- and post-mortem. The age, sex and size of the dog(s) are variable and other animals may be included in the burial as well.

Two examples of associated deposition come from the Natufian period in the southern Levant. At the site of Hayonim Terrace two dogs were deposited with the bodies of three humans in an egg-shaped pit (Tchernov and Valla 1997). The fully articulated dogs were placed together in the pit along with tortoise shells and covered with a limestone block upon which the human remains were then placed. At nearby Ein Mallaha, a puppy was also deposited with the body of a human (Davis and Valla 1978; Fig. 3.11). Variations of the human-dog associated deposition are seen from around the world (Blau and Beech 1999; Geus 1991; Hamilakis 1996; MacKinnon and Belanger 2006; Olsen 1985; Tuck 1976; Yohe and Pavesic 2000).

Figure 3.11. An associated deposition of a puppy placed near the head of a human burial at the site of Ein Mallaha, Israel (photograph: Davis and Valla 1978)

Component

Dog remains found in a *component* deposition are normally fully articulated, save for taphonomic or post-depositional factors, but are sometimes in partial articulation as well. They are interred either alone or with other non-human animals. The body is found in a prepared pit or other intentional depositional setting and has placed positioned with deliberate attention given. In a very important contrast to an isolated burial, this type of deposition is located outside any collective dog deposition cemetery. The dogs often display peri- and/or postmortem trauma consistent with dispatch, butchery and/or skinning. The age, sex, and size of the dogs are variable, although component depositions often show repetition in the age of dog included (Collins 1990). The dogs are sometimes found with grave goods, commonly referred to as *altar offerings* or *ritual goods* (Olsen 2000).

The form and characteristics which make up the component deposition may otherwise be referred to as *ritual*, but given the problematic interpretations related to 'ritual' the term has been avoided. The breakdown of the concept of *ritual* from its meta-level explanation to more useful concepts is still a difficult task for archaeologist, yet needs to be further examined (Brück 1999; Morris 2012). This type is applied to those depositions which in appearance express some alternative function beyond the mere deposition of a carcass. This function could be anything from religious or cult-related to secular and more practical purposes. A key to interpreting component deposition may lie in the historical literature which suggests domestic animals, specifically dogs, are among the preferred animals used for 'ritual' killings (Pluskowski 2012). These types of depositions may follow specific sequences with applied rules that make the context of the depositions similar across a cultural group and thus easier to identify in the archaeological record (Richards and Thomas 1984). The common practice of depositing dogs in building walls or foundations, perhaps as a symbol of healing and protection (Morris 2012), has lead some researchers to refer to these component depositions as *dedicatory interments,* fulfilling some sort of commemorative function (Emslie 1981).

The presence of dogs deposited beneath structure floors in archaeological contexts (Day 1984; DeJarnette and Wimberly 1942; Loehr 1957; Ó Súilleabháin 1945), may be related to ethnographies that describe the deposition of sacrificed dogs beneath house floors as an offering for protection and good health (Erb 1991; Mery 1968). At the Eneolithic site of Botai in Kazakhstan, at least 15 dogs were deposited in component interments. These canids, both complete and partial remains, were placed in pits to the west of houses, a location associated in Indo-European and Indo-Aryan mythology with an 'Otherworld' guarded by two dogs (Jones-Bley 1997; O'Flaherty 1981). Across the rest of the site numerous dogs were interred in pits beneath house floors, many associated with ochre, flint, projectile points, and various other faunal remains (Olsen 2000; Fig. 3.12).

Figure 3.12. A component deposition of a dog placed in a pit to the west of a house from the site of Botai, Kazakhstan (photograph: Olsen 2000)

Elemental

Elemental deposition is the inclusion of individual dog skeletal elements, most often the skull, mandible or teeth, in the burial of humans (Fig. 3.13). Elemental depositions are always associated with human remains. As elemental deposition involves only single elements, there is no articulation or specific positioning and the age, sex, and size of the dog deposited are variable. These elements often show evidence of trauma, specifically related to skinning, butchery, or dispatch. As with the inclusion of other animal elements, the inclusion of dog elements with human burials is often interpreted as grave goods (Gräslund 2002; Kerber 1997; Parmalee 1960).

Several examples of elemental deposition have been found from the Iron Gates Mesolithic period at sites along the Danube Gorge. At Lepenski Vir, a single dog mandible was found along with elements from various other animals in the burial of a human male. At the nearby site of Vlasac, two other human males were also found buried with dog mandibles (Radovanović 1999). The deposition of dog skulls, mandibles, and teeth with humans is a fairly common phenomenon occurring worldwide, including from the Late Eskimo period in Canada (Osborne 1952), Romano-British Oxfordshire (Wilson 1986), 17th-century Barbados

(Handler 1997), Iron Age Italy (Facciolo and Tagliacozzo 2006), prehistoric Louisiana (Webb 1948a), Neolithic Latvia (Zagorska 2008), and Late Shang China (Ying 2009).

Figure 3.13. An elemental deposition from a site in Oechlitz, Germany, in which a human was covered with dog teeth upon burial (photograph: Saxony Anhalt Office for Monument Protection and Archaeology)

Expedient

Expedient deposition is largely a miscellaneous type that is defined more by negative evidence than the characteristics which it displays. This type of deposition is sometimes referred to as a *simple interment* (Hill 2000), *nonburial*, or *refuse* (Beisaw 2007) due to the apparent lack of attention and expedient nature. In an expedient deposition the animal may be of full, partial or no articulation and the body positioning is haphazard (Fig. 3.14). There may be evidence for a deposition pit, but more commonly these remains are deposited in trash middens, trenches, wells and other locations which facilitate convenient disposal. Trauma is quite common, specifically butchery or skinning marks and there is a lack of any grave good associated with the deposition. Age, sex and size are all variable.

As a result of the nature of this category including all those depositions which cannot be otherwise described by the characteristics present in the previous types, expedient depositions are among the most prevalent in the dog interment record. It has been suggested that animals with this type of deposition represent those culled due to illness or as community pests (Morey 1997), butchered debris (Chenal-Vélardé 2006), and ritual trash (Russell, et al. 2009). As suggested by Hill (2000), it is hoped that as dog interments become a more prominent focus of contextual analysis the expedient type can be defined in greater detail or eliminated as more comprehensive patterns of dog interment are identified.

Figure 3.14. An expedient deposition of many dogs dumped in a pit from Hierakonpolis, Egypt (photograph: Renee Friedman)

Limitations of the Typology

Though useful as a set of terminology and types for dog depositions, this typology is not without its limitations. Most importantly it must be stressed that interpretations cannot be tied directly to the typological categories. These types are merely starting points from which the context and individual variables from each deposition must be introduced. As observed through our everyday encounters, a dog can be many things at the same time and mode of deposition does not necessarily reflect position in life. Moreover, as more dog depositions are excavated and analyzed, there are likely to be additional patterns of deposits discovered. Perhaps the most challenging obstacle to this typology (and any associated interpretations) is its reliance on the physical characteristics of the deposition as found in situ and reported by the original excavation team. Although there have been recent calls for detailed recording of dog deposition at archaeological sites (Crockford 2009), descriptions of faunal remains from archaeological reports, specifically those made before the proliferation of zooarchaeology, are often severely lacking in the detail needed to confidently identify the type of dog deposition encountered.

More specific issues come in the physical nature of the depositions themselves. Post-depositional disturbances and taphonomic effects can severely alter the physical characteristics of the deposition, proving problematic when analyzing a deposition for type. Additionally, mortuary processes such as bundle depositions and cremation, often seen in archaeological dog depositions (Kerber 1997; Mäntylä-Asplund and Storå 2010; Williams, et al. 2001), can be challenging as they can leave little in the way of physical evidence of articulation, positioning, trauma and pathologies, age, sex, and size. It is hoped that the use of this typology will bring about more detailed analysis and discussion between researchers about depositions, confronting and eventually resolving the issues that affect this typology currently.

Conclusions

The dog's history of varying cultural roles and a liminal social position between animal and human throughout time has led to highly variable depositional modes, as well as interpretations about these modes. The creation of a shared vocabulary for dog depositions is essential when interpreting their meaning and eventually reaching a better understanding of the human-dog relationship in the past. A critical part of creating this vocabulary is the separation of the description (*how*) from the interpretation (*why*) of the interment. The development of a descriptive language for dog deposition, the first of its kind, through this typology will lead to clearer interpretation on both a site and cross-cultural level. The methodical analysis and reporting of each deposit through these identified characteristics and descriptive types will allow researchers to discuss depositions through a common terminology, thus encouraging comparison between sites. It is hoped that the use of this typology will encourage a more thorough examination of existing and future dog mortuary deposits, leading to additional characteristics and types being identified as well as an improved understanding about depositions from different archaeological sites.

Chapter 4: Archaic Dog Burials in the Midsouth United States

Introduction

Since their discovery in the 1930's, Archaic-period dog burials in the southeastern United States have been recognized as a diagnostic cultural phenomenon of the area, and one which has received much research attention (e.g. Cole and Koerper 2002; Fitzgerald 2009; Handley 2000; Hill 1972; Lewis and Kneberg 1959; Milner and Jefferies 1998; Morey 1992; 2006; 2010; Morey and Wiant 1992a; Walker 2010; Walker and Morey 2005; Walthall 1999), with Morey (2006: 159) even referring to them as the 'Emblem of the Archaic'. The recognition of these large clusters of prehistoric hunter-gatherer dog burials in the southeast began with excavations funded by the U.S. Government's Works Progress Administration (WPA), in order to provide employment during the Great Depression. The excavation of these sites, primarily consisting of large shell middens along the Green River of Kentucky and the Tennessee River in Alabama and Tennessee (Fig. 4.1), was instrumental in developing the very concept of the Archaic period in eastern North America. William Webb, William Haag, and David DeJarnette, the archaeologists who headed the majority of the excavations in the area during the time, consistently noted the degree of attention with which dogs were buried in Archaic levels (e.g. Webb 1946; 1950a; Webb and Haag 1940b). Using the previously described dog burial typology (see Chapter 3), 349 individual isolated dog burials have been identified from 40 Archaic sites in the Interior Midsouth (hereafter IMS) of the United States (see Appendix 1). While these 349 isolated burials have been positively identified through original site reports and in-situ excavation photographs when possible, there are many other dog remains from the area which have been excluded from this discussion due to bad preservation and/or disturbance. Additionally, as many of the southeastern excavations took place before the advent of thorough zooarchaeological recording, the detailed information needed to positively identify many other possible isolated burials is often lacking. An abundance of miscellaneous, complete dog bones without evidence for skinning, butchery or other dispatch trauma suggests that the phenomenon of intentional, isolated dog burials from Archaic sites in the region may be much more prolific than even this data suggests.

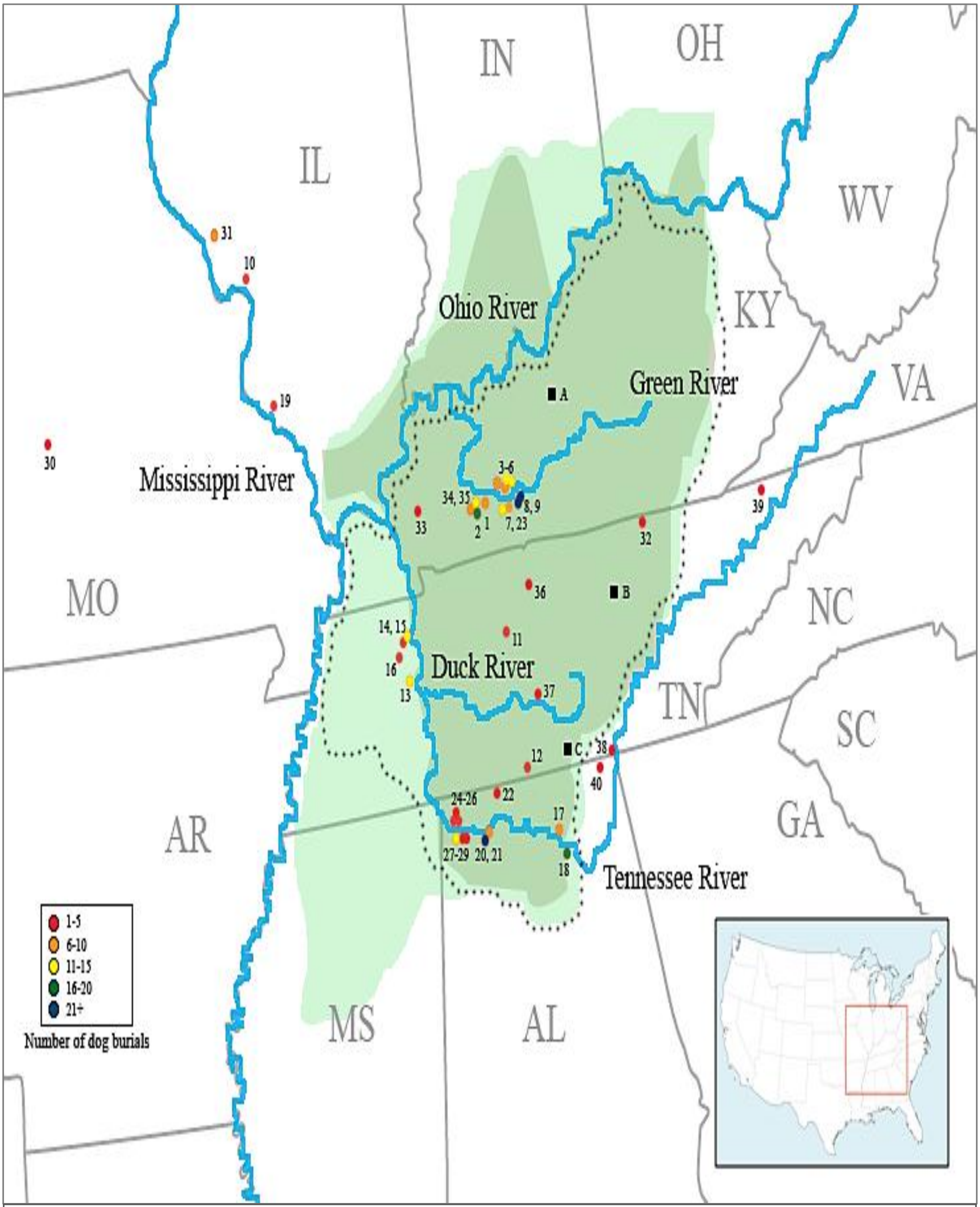
While it is clear that the height of the isolated dog burial phenomenon in the United States took place at the Middle Archaic semi-sedentary/sedentary shell midden sites of the Interior Midsouth, the data suggest that the occurrence has its beginnings at non-shell midden sites, in areas just outside the Interior Midsouth, where isolated dog burials started in small numbers, just after the Pleistocene-Holocene transition. Similar isolated dog burials have occasionally been found from Archaic levels at sites in other parts of the eastern United

States, yet over 94 % of known Archaic dog burials are from archaeological sites located on the large river systems of the Interior Midsouth (Claassen 2010). Due to postglacial climate changes, these riverine environments became highly productive, and were surrounded by abundant woodland resources of nuts and white-tailed deer, leading groups of Archaic peoples to settle in the area and develop large shell mound habitations as a result. The proliferation of these shell mounds along the midsouthern rivers has often led to the term 'Shell Mound Archaic' (SMA) being used to describe the sites from this area. The SMA is generally defined as the shell mounds located on the Green River in Kentucky, and on the Tennessee River in Tennessee and Alabama, along with their numerous tributaries and associated waterways (Fig. 4.1). The intensive formation and use of these shell mounds began around 8,000 cal B.P. and continued until the implementation of agriculture, variously from about 3,200 to 1,000 cal B.P. During this time, in correlation with the formation of large shell midden cemeteries, growing populations, increasing pressure on subsistence resources, and escalating warfare between groups, the intentional burial of dogs, in a manner similar to humans, was a regular occurrence. Their careful treatment, lack of dispatch trauma, occasional inclusion of hunting-related tools, the presence of hunting-related injuries, and a known proficiency for hunting deer, all suggest their interment at IMS sites is a result of their importance as a white-tailed deer hunting tool, an importance which only increased as population growth in the Middle Archaic diminished group territories and stretched resources even further. Overall, the pattern of isolated dog burials beginning in small numbers at shell-free Early Archaic sites, then reaching their maximum numbers at the large shell middens sites, before decreasing again at the Late Archaic shell-free sites suggests that the intensive use of hunting dogs began as a postglacial hunting adaptation, which intensified with increasing populations and resource pressure through the Middle Archaic, then lost its importance with the advent of agriculture.

Though the status of shell midden sites which contain isolated dog burial is unquestionably Archaic in nature, researchers have struggled to define temporal subdivisions for the various Archaic stages. Most of the shell midden sites were excavated before the introduction of radiocarbon dating, and though many researchers have discussed the need for better dating of the sites (including direct dating on bones; e.g. Claassen 2010), extensive radiocarbon dating has not been undertaken for a majority of the Archaic sites in the region. This leaves many sites dated stratigraphically through projectile point typologies. Nevertheless, all dog burials have been found in aceramic Archaic levels with hunter-gatherer occupation and no evidence of intensive plant cultivation. In this chapter and Appendix 1, the most current radiocarbon dates for each site have been used, when radiocarbon dates were available. While only one dog burial has been directly dated, a number of sites have radiocarbon dates from items in direct association with the dog burials. Sites which have dates that include longer spans of time are either dated stratigraphically through projectile point typologies, have multiple dog burials which occur throughout different temporal periods, or have bracketed radiocarbon dates for the oldest and youngest levels of the site, but not individual layers. Throughout this chapter chronological periods following Anderson (2001) have been used (Table 4.1).

Younger Dryas	c. 12,900-11,650 cal B.P.
Late Palaeoindian	c. 12,900-11,450 cal B.P.
Early Archaic	c. 11,450-8,900 cal B.P.
Hypsithermal	c. 8,900-5,700 cal B.P.
Middle Archaic	c 8,900-5,700 cal B.P.
Late Archaic	c. 5,700-3,200 cal B.P.
Early Woodland	c. 3,200-1,000 cal B.P.

Table 4.1. Dates of different time periods and climatic events in the prehistory of the Interior Midsouth (after Anderson 2001)



1: Butterfield
2: Ward
3: Jimtown Hill
4: Jackson Bluff
5: Indian Knoll
6: Chiggerville
7: Baker (Andrew's Run)
8: Carlston Annis
9: Read
10: Koster
A: Anderson Pond

11: Anderson
12: Bailey
13: Eva
14: Kays Landing
15: Big Sandy
16: Cherry
17: Whitesburg Bridge
18: Flint River
19: Modoc Rockshelter
20: Perry
B: Jackson Pond

21: Little Bear Creek
22: Mason Island
23: Bowles
24: O'Neal
25: Dust Cave
26: Bluff Creek
27: Mulberry Creek
28: Long Branch
29: Pride
30: Rodgers Shelter
C: Mingo Pond

31: Apple Creek
32: Robinson
33: Morris
34: Kirkland
35: Barrett
36: Duncan Tract
37: Hayes
38: Westmoreland-Barber
39: Phipps Bend
40: Russell Cave

Figure 4.1. Map of locations discussed in the chapter, including the interior low plateau (light green), the western mesophytic forest (dark green), the Interior Midsouth (dotted outline), archaeological sites (colored dots), and pollen sample locations (black squares)

Location

The midsouthern portion of the United States was in the early Holocene, as it is today, a highly variable landscape of shifting ecotones and physiogeographic regions. In her seminal work on the forests of eastern North America, prominent botanist and ecologist E. Lucy Braun (1947; 1950) argued that the forest systems of the midsouthern United States have changed little in their general make up since the postglacial transition in the early Holocene (Braun 1950), a statement supported by Delcourt's (1979) assertion that the arboreal flora of the region has maintained a similar composition from 9,500 years to the present. For the purpose of this research, the Interior Midsouth of the United States is being defined as the area which lies in the center of the eastern United States, primarily encompassing the area of Kentucky, Tennessee, and northern Alabama states (Fig. 4.1). This region is bounded to the north by the Ohio River which makes up the southern border of Illinois, Indiana, and Ohio. To the east and southeast are the Appalachian Plateau and Mountains. The south and southwest are bordered by the Coastal Plain of the southern states, and to the west are the Mississippi River and the great prairie plains of the Midwest.

Although this area is the principal location for 33 of the 40 sites of isolated Archaic burials, there are 7 other sites, chiefly along the Mississippi River in Illinois and on the Tennessee River just to the east of the main cluster of sites, which have principal burials as well (Fig. 4.1). Interestingly, of these sites that fall outside of the isolated range, none are shell-bearing sites, instead consisting of rockshelters, caves, and open-habitation villages which display fairly low numbers of dog burials, with only 18 burials between the 7 sites. Additionally, the sites that fall outside of the primary cluster tend to be those with the oldest and youngest dates, with four of the sites having burials dating to before 7,400 cal B.P., and the other three dating to after 3,300 cal B.P. This suggests that the practice of isolated dog burials began in small numbers at shell-free sites during the very early Holocene, but reached its climax at the large Middle Archaic shell midden sites of the Tennessee and Green River valleys, where over 89 % of the isolated dog burials are found, before tapering off at shell-free hunter-gatherer villages in the very Late Archaic and Early Woodland periods. The region of intensive clustering of burials is encompassed by what Braun (1950) has described as the Western Mesophytic Forest region, which is also essentially the area known as the Interior Low Plateau to physiographers (see Fenneman 1938). Unlike the majority of the surrounding forest regions, this locality is not made up of a single climax type, but is a transition region comprised of a complex mosaic of hardwood deciduous species, including oak, hickory, chestnut, beech, and alder, an ideal location for white-tailed deer. In addition to a wide variety of forest types, the region also has extensive alluvial swamps, especially along the lower Green River. Perhaps not surprisingly, the area with the majority of IMS dog burials corresponds almost exactly to the geographic region of the Interior Low Plateau and Braun's

Western Mesophytic Forest (Fig. 4.1), suggesting there is a correlation between the occurrence of dog burials and the variety of resources available in this particular ecotone. Claassen (1996) has noted that the focus and intensity of shell middens in the Tennessee and Green River areas is curious given that highly productive mussel beds are found throughout Kentucky and Tennessee, and in fact extensively throughout the Mississippi River watershed in the midsouthern U.S. It is probable that this particular ecotone, with its highly productive riverine resources, high variety of trees with edible nuts, and ideal forest type for white-tailed deer, created an advantageous location where, due to postglacial environmental change, numerous abundant subsistence resource patches coincided and were taken advantage of by local hunter-gatherers.

Palaeoenvironmental Reconstruction

The climate changes associated with the Pleistocene-Holocene transition (see Chapter 2) were felt by hunter-gatherers throughout the eastern United States, but were particularly abrupt in the temperate region of the Interior Midsouth. As revealed by early Holocene faunal remains and pollen samples from the area, rapid shifts in environments led to similar shifts in prey species populations. While pollen and faunal samples from the Late Pleistocene IMS leave no doubt that the area had a cool, moist environment, inhabited by boreal forest and parkland species (e.g. Graham and Mead 1987; Guilday, et al. 1978; Guilday, et al. 1971), researchers have highlighted how significantly unique the environmental change of the last deglaciation was (Graham 1986; Jacobson, et al. 1987). These shifts would have left hunter-gatherers who were accustomed to life in a boreal forest, pursuing small game and the occasional megafauna, with the decision to follow the pine forests and their accompanying prey species north in their retreat from warming temperatures, or to continue to inhabit the midsouthern landscape, and thus adapt their hunting methods to the succeeding environment and prey animals. At the same time, in other parts of the northern latitudes, similar decisions were being made by hunter-gatherers in Northern Europe (see Chapter 5) and Japan (see Chapter 6). Researchers are nearly unanimous in their depiction of the events leading to the flourishing of Archaic sites, especially the large shell middens, of the Interior Midsouth. While the increasingly warm and dry climate of the region forced cold-weather species northward, the same conditions encouraged the rapid influx of deciduous nut-bearing hardwoods, which Archaic people responded to opportunistically by creating winter resource caches (Anderson 2001), and accompanying woodland fauna, specifically white-tailed deer, from the deep south. Furthermore, these same warm, dry conditions combined with sea level rise, which inundated the waterways of the Mississippi River drainage basin, and created an abundant, fixed supply of riverine aquatic resources (Claassen 1996; Dye 1996). Access to a plentiful supply of three key resources, white-tailed deer, shellfish, and hardwood nuts, would have made for a location that took advantage of the resources from both the large midsouthern rivers and deciduous forests, creating environments ideal for Archaic period hunter-gatherers.

Unfortunately, sparse coverage of late Quaternary palaeoecological sites within 300 km south of the late Wisconsin glacier margin leaves the precise details of the change in vegetation during and post deglaciation difficult to decipher. Yet, there is abundant data from the few sites which have been published, including Jackson Pond, Anderson Pond, and Mingo Pond, all of which have produced continuous pollen records from the Pleistocene forward. Jackson Pond (Fig. 4.1) is a 3-ha, spring-fed sinkhole located in Larue County, northcentral Kentucky from which a sediment core has been taken with samples dating back to 20,000 years cal B.P. (Wilkins, et al. 1991). Pollen diagrams from the site demonstrate that from about 10,000 to 7,300 cal B.P. the area was dominated by mesic deciduous forest, primarily comprised of oak, hornbeam, and hickory (Fig. 4.2). After about 7,300 yr cal B.P. the more xeric conditions of the Hypsithermal encouraged an increase in oak to over 60%, with hickory, chestnut, and willow also in high abundance (Wilkins, et al. 1991). Anderson Pond (Fig. 4.1) is a 34.8-ha sinkhole located in White County, northcentral Tennessee from which samples from 25,000 radiocarbon years B.P. to the present have been collected (Delcourt and Delcourt 1979). Similarly to Jackson Pond, after about 11,500 yr cal B.P. oak, hornbeam and ash begin to enter the record, along with a continuation of pine from the boreal forests (Fig. 4.3). By 9,500 yr B.P. there is a decrease in hornbeam and the assemblage is dominated by oak, ash, and increasing hickory. Additionally, after 9,500 yr cal B.P. there is an influx of warm-temperate taxa such as chestnut, black gum, and maple, as well as pollen from numerous swamp shrubs which supports the theory that rising sea levels were inundating the river systems, forming swampy backwaters. At about 8,000 yr cal B.P. pollen for oak, ash, hickory, birch, and alder begin to increase and continue to increase through 5,000 yr cal B.P. As is seen at Jackson Pond, by about 5,000 yr cal B.P. the more mesic deciduous taxa have decreased as a result of the more xeric conditions at Anderson Pond (Delcourt and Delcourt 1979). Mingo Pond is a 15.6-ha sinkhole in Franklin County, southcentral, Tennessee with its oldest sediments dating to around 14,000 yr cal B.P. Similarly to both Jackson and Anderson Ponds, at this site oak dominates the record, representing between 73 and 84 % of the early Holocene record. Other significant pollen types include those for hickory, walnut, elm, and hornbeam (Delcourt and Delcourt 1979).

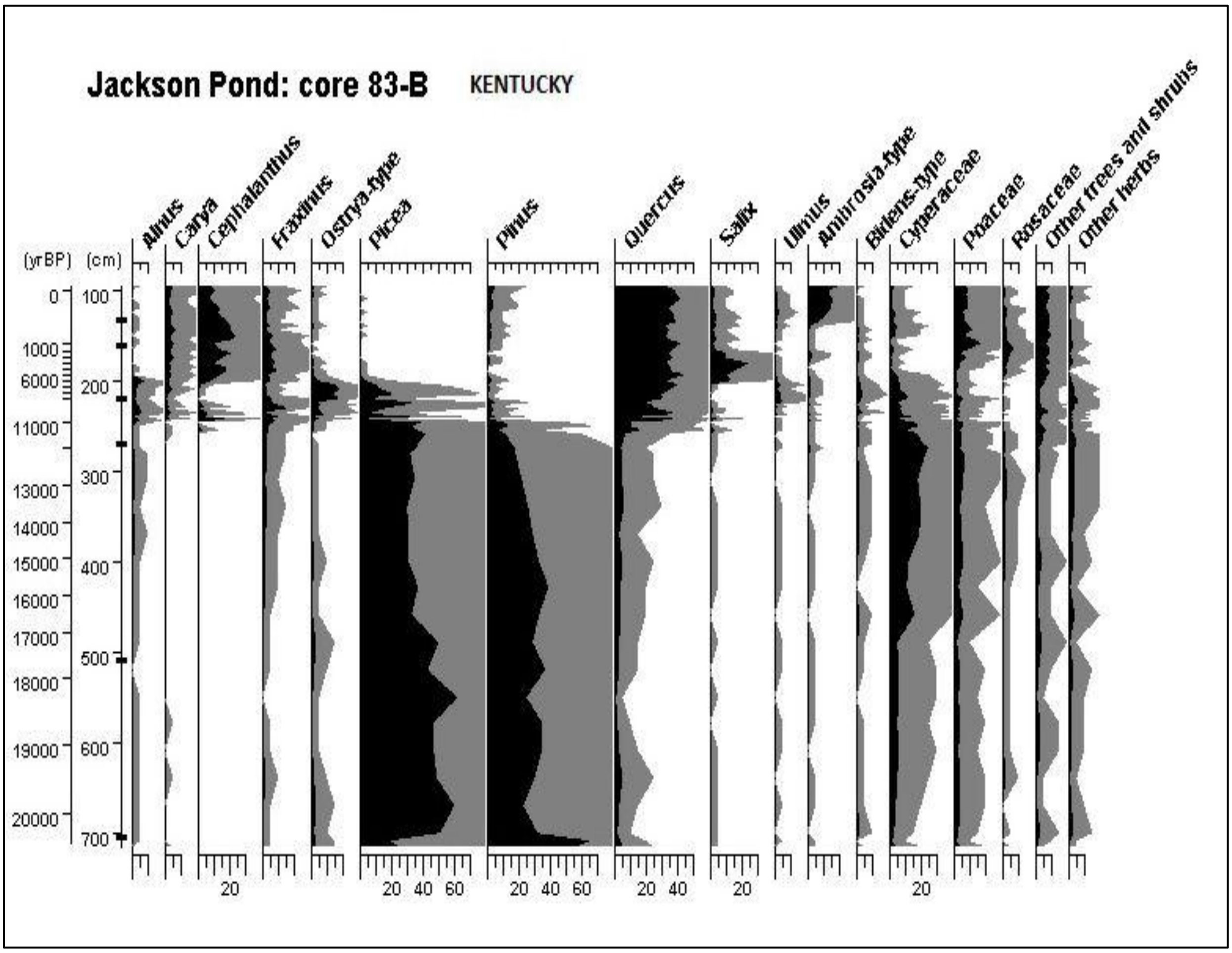


Figure 4.2. Pollen analysis from Jackson Pond, Kentucky showing high percentages of spruce and pine during the Pleistocene, with a change to high percentages of oak and other deciduous plants after the Holocene transition (Jacobson, et al. 1987)

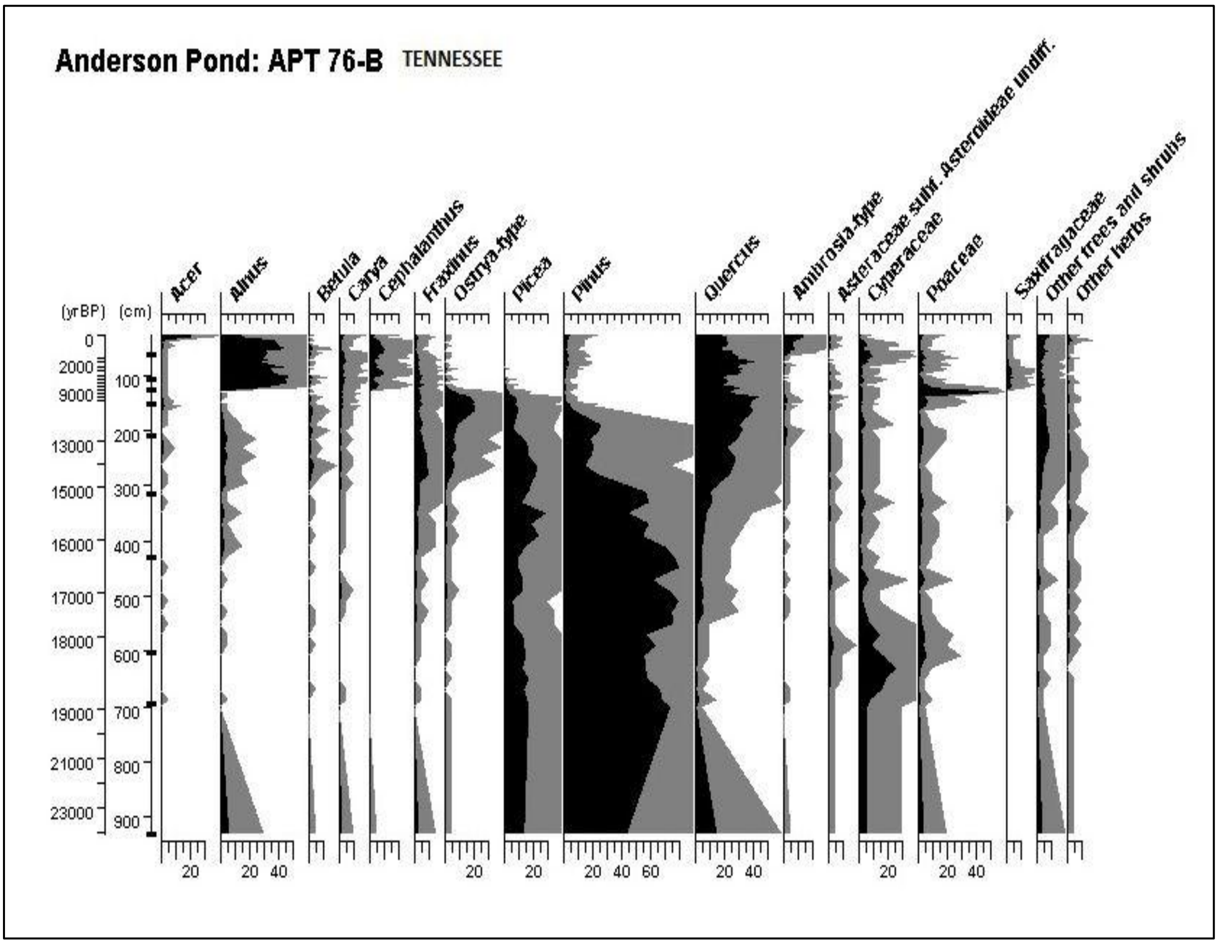


Figure 4.3. Pollen analysis from Anderson Pond, Tennessee showing high percentages of spruce and pine during the Pleistocene, with a change to high percentages of oak and other deciduous plants after the Holocene transition (Jacobson, et al. 1987)

At each of the three palaeoecological sites available for this region, pine dominated the Late Pleistocene landscape. After 10,000 yr cal B.P., the glacial ice had fully retreated and the temperate deciduous forests with high nut yields, such as oak, hickory and chestnut, were pushing north into the Interior Midsouth from their southern refuges. The tributaries to the east of the Mississippi River, including the Tennessee and Green River, included a dense collection of meandering streams and ponds lined with hardwood forests, ideal for white-tailed deer. The pollen data indicates that mid-Holocene conditions became increasingly warmer and drier, with maximum xeric conditions between 6,500-5,000 yr cal B.P., events that closely parallel the climatic impact of the Hypsithermal (Bense 1987; Muto and Gunn 1985).The Hypsithermal event has long been associated by archaeologists with the explosion of social complexity in the area (e.g. Phillips and Brown 1983) and it continues to be suggested that the Hypsithermal could explain the phenomenon (e.g. Marquardt and Watson 2005). Rather than enhancing the aquatic resources of the entire midcontinent, the Hypsithermal resulted in aquatic resource-rich patches (Walthall 1990), which coincided with rich areas of nut tree and white-tailed deer populations. At the same time rising populations and increasing group densities would have put more pressure on even a flourishing landscape. Subsistence ranges between groups would have become increasingly restricted and hunting risk would increase as resource ranges decreased, encouraging territoriality and leading to the violent warfare which is evident at many IMS Archaic sites. These difficult circumstances would encourage local foragers to maximize their hunt returns through the use of technological tools, further strengthening the dog's importance as a valuable hunting innovation and vital member of the hunting group.

Burials

Across the entirety of the dog burial record for this region, excavators have continually noted a particular level of attention and care afforded to dogs in their interment (Curren 1981; Dowd and Breitburg 1989; Fowler 1959; Webb 1938; 1939; 1950a; b; Webb and DeJarnette 1942; 1948a; Webb and Haag 1940b; 1947). This attention often includes prepared burial pits (or additional piling of shell over the remains), grave goods, and interments that generally mimic the care afforded humans at the same site. Of the identified isolated burials over 43 % were reported to have prepared grave pits (25 % did not have information provided about grave pits), and 15 % had grave goods (25 % did not have information about included grave goods). Grave goods from dog burials include a stone mano and metate (Koster), lithics (Rodgers Shelter, Russell Cave, Dust Cave, Eva), stone slabs or tumuli (Rodgers Shelter, Russell Cave), and tools (Eva) (see Appendix 1). A dog from Russell Cave buried in a "coffin", which consisted of a stone slabs beneath and around the sides, and with a stone projectile point prompted Miller (1956: 556) to state that Archaic dogs in the area were highly valued as hunters seeing how the dog was a given a "much more careful burial than the man" (a human burial from the same site). According to radiocarbon dates, the beginning of isolated burials in the midsouthern portion of the United States occurred not in the large shell mound sites of the Interior Midsouth, but further northwest along the Mississippi River at a site called Koster in Illinois (Fig. 4.1). At Koster, a highly-stratified shell-free site, three isolated dog burials were excavated, including one with grave goods. Recent direct radiocarbon dates from the dogs date their remains to between 10,110-9,700 cal B.P. (Widga, et al. 2012), making them the oldest isolated dog burials in North America. Interestingly, some of the other oldest isolated burials are also from nearby shell-free sites outside of the Interior Midsouth, including two burials from Modoc Rockshelter (ca. 8,000-7,650 cal B.P.) in Illinois and one burial from Rodgers Shelter (ca. 7,450 cal B.P.) in Missouri. In addition, two of the earliest sites in the IMS, Dust Cave (c. 8,400 cal B.P., two isolated burials from this level) and Russell Cave (c. 8,000 cal B.P., one burial) are non-shell bearing sites. This suggests that the practice of isolated dog burials began in smaller numbers at Early Archaic hunter-gatherer sites, before the intensified utilization of shellfish resources in the eastern river valleys, then spread and became a regular practice amongst people at the Middle and Late Archaic shell midden sites of the Interior Midsouth (Table 4.2; Fig. 4.4).

Phase	**# of Sites**	**# of Burials**
Early Archaic	1	3
Early-Middle Archaic	1	11
Middle Archaic	8	28
Middle-Late Archaic	12	199
Late Archaic	10	68
Late Archaic-Woodland	6	31
Woodland (Foragers)	2	9
TOTAL	**40**	**349**

Table 4.2. Isolated dog burials from the Archaic and Woodland periods of the Midsouth

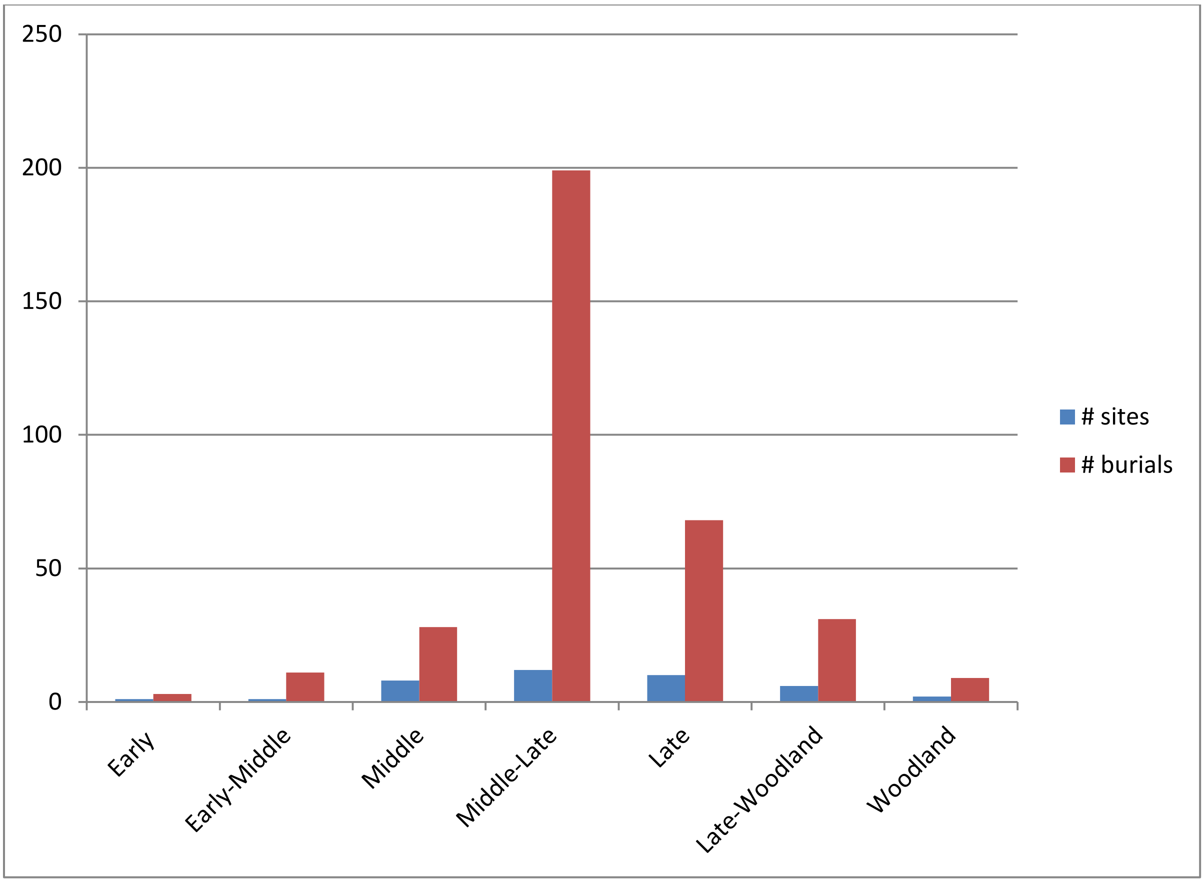


Figure 4.4. Number of Archaic and Woodland period archaeological sites with isolated dog burials

While some sites in the IMS, particularly the very oldest and very youngest Archaic sites, include relatively low numbers of dog burials, they are much more prolific at others. At the Read site in Kentucky, the location of the highest proportion of dog burials during the

Archaic, dogs make up 20.3 % of the total burials found, dog or human. Similar percentages are seen from Kirkland (12.5 %), Chiggerville (9.5 %), Carlston Annis (6.7 %), Butterfield (5 %), Ward (5 %), Barrett (3.1 %), and Indian Knoll (2.3 %), among others (Claassen 2010). Outside of the Interior Midsouth region, dog burials in Archaic components are uncommon. They are even less common in the time period following the Archaic, the Woodland period, and occur only sporadically in the later Mississippian and protohistoric periods (Cantwell 1980; McMillan 1970; Warren 2004). Although there is evidence of occasional consumption of dog during the Archaic, there was a clear increase in the practice during the Woodland and later periods. Snyder (1995) stated that consumption of dogs significantly increased in the nearby Middle Missouri peoples over time, likely due to a high degree of subsistence stress, yet Barkalow (1972) found no evidence for dog consumption among faunal remains from 23 Archaic IMS sites in northern Alabama, along the Tennessee River. Haag (1948), Parmalee (1962), Smith (1975), Morey (2006) and others have all suggested that the decrease of intentional burials and increase in consumption of dogs during the later Woodland and Mississippian periods reflects a decline in the importance of dogs to local groups after the Archaic. Haag (1948) noted that the decline of isolated dog burials coincided with increased reliance on agricultural subsistence, and suggested the shift in treatment reflected a general devaluation of dogs as hunting became less important, while Parmalee (1962: 406) stated that in later periods, “the dog was not a revered animal as was often the case in Archaic and other early cultures”. Smith (1975: 110) also drew a connection between the use of dogs for hunting and their cultural importance or esteem as seen through careful burial, noting from the later agricultural-based societies, “almost a total lack of evidence for intentional interment of dogs at Middle Mississippian sites suggests dogs were not held in much esteem in the villages”. In this vein, Warren (2004: 8) has suggested that more work needs to be done on “the notion that dog function and treatment may have varied among cultures in ways that are visible in the archaeological record”.

The suggested relationship between isolated dog burials and the use of dogs as valuable hunting tools is further supported by the evidence present in their physical remains. When analyzing the remains, Warren (2004: 63) noted that as the dogs increased in age, the representation of the sexes changed dramatically. In the Archaic series as a whole, the young adult category saw a 1:1 ratio of males and females, but by middle adult that ratio had increased to favor male dogs by 3.41:1, and in the old adult category all 12 samples were identified as male. This apparent preference towards the burial of male dogs may reflect a belief, either real or imagined, that male dogs are more suited to hunting. Older dogs and male hunting dogs used by modern subsistence hunting groups have been associated with significantly greater kill ratios than female dogs (Koster and Tankersley 2012). As would be expected, middle adult dogs, who would make up the bulk of a living hunting dog population, dominate the IMS assemblages, while subadults, particularly young puppies are underrepresented (Warren 2004: 243). High frequencies of skull and rib fractures seen in these dogs are consistent with encounters with large, aggressive animals that may have occurred while hunting, and canine and premolar fracture frequencies also suggest increased contact with large, struggling animals in the Archaic. Warren (2004: 246) all notes that significant injuries on the spinous processes increased *after* the Archaic, suggesting Woodland period dogs were being used increasingly as beasts of burden, as opposed to hunting aids. Curiously, carnivore gnawing on faunal remains has only been noted from three sites that include dog burials (Claassen 2010). This suggests that dogs may have been tied up or penned, which is in line with the practice of keeping hunting dogs separated to limit unwanted breeding or fights, as seen in modern hunting dogs (see Chapter 7). In her examination of the skeletons of the IMS dog burials, Warren (2004: 248-249) concluded that consistent traumas seen on the bones of buried dogs suggested that burial treatment was preferentially applied to dogs that performed an economically important function.

Carlston Annis, KY (c. 8,770-2,537 cal B.P., 25 isolated burials)

The Carlston Annis site (sometimes referred to as the Carlson Annis site), which began excavation in 1939, is a large, elliptical shell midden (350 x 300ft, 7.5 feet tall) located on the bottomland of the Green River in westcentral Kentucky (Webb 1950a; Fig. 4.1). Radiocarbon dating of the site spans from 8,770-2,537 cal B.P., with all dog burials being located in the Archaic levels (Claassen 2010; Marquardt and Watson 2005), but none being directly dated. Researchers have long argued that Carlston Annis, as well as many of the other large shell midden sites across the IMS, represent fairly permanent settlements due to their large size and continuous temporal occupation (e.g. Pedde and Prufer 2001a). While subsistence at Carlston Annis incorporated a number of species, including birds, reptile, fish, and high percentages of acorn and hickory nuts in every level, white-tailed deer was the most exploited prey species, ranging from 70 to over 80 % in every level of the site (Crothers 2005: 312). In his own calculations Glore (2005) noted that white-tailed deer remains at the site averaged 73.6 % of the total faunal sample, outside of shellfish, from which he concluded, "terrestrial subsistence pursuits at Carlston Annis were conspicuously centered around hunting of white-tailed deer" (Glore 2005: 327). Additionally, Glore (2005) suggests white-tailed deer would have preferred the woodland around the midden, an abundant source of acorns, and were available to hunt throughout the year.

While a wide variety of subsistence species are represented at Carlston Annis, including the ever-important white-tailed deer, which are the predominant prey targeted, there is some suggestion that territoriality and subsistence range disputes were a problem for the people of Carlston Annis. Of the 390 human burials identified from the site, over 23 % of the skeletons show evidence of a violent death (Crothers 2005), an occurrence noted in the earliest reports from the site (Webb 1950a; Webb and Haag 1940b). In her analysis of the human remains, Claassen (2010) noted evidence for a scalping, 10 decapitations, 5 embedded points, 10 perimortem head fractures, and 8 dismemberments. As noted by Webb (1946) and confirmed by Mensforth (2001: 117), at the Carlston Annis site victims of perimortem violent injury are commonly associated with graves containing multiple burials, which account for the location of 36.4 % of the individuals with violent perimortem injuries here. Prufer and Pedde (2001a) have suggested that violence at Carlston Annis and other large shell midden sites in the IMS is the result of ecological pressures and competition for subsistence resources among growing populations. This is supported by the work of Meindl et al. (2001) which estimates an annual adjusted growth rate of about 2.5 % per year, meaning the population of the site would have doubled every 30 years. In light of this, the theory that dogs at Carlston Annis were used as an advantageous hunting tool to maximize kill rates seems particularly convincing.

Dogs are represented at Carlston Annis is a variety of ways. While there are miscellaneous dog bones found throughout the site, there is also a rostrum which has been included in the burial of a four year-old child, and canine teeth are fairly common in burials. Four complete dogs have also been buried with humans, both male and female, from ages 17-42 (Mensforth 2001). There are also 25 isolated dog burials (Fig. 4.5), which Crothers (2005: 308) suggests cements their status as domesticated companions based “in the view of their purposeful interment in much the same fashion as humans.” This care in burial was also noted by Webb (1950a: 272) in his site report when he stated, “as is usual in the shell middens, dogs were often buried with the same care as that given to human burials.” He also noted that the isolated dog burials were placed in either round grave pits in the subsoil, or in the shell midden, with additional shell heaped over the remains (Webb 1950a: 272). The various modes of dog interment suggests that dogs played diverse roles at the site and were clearly, in turn, treated quite differently upon their death.

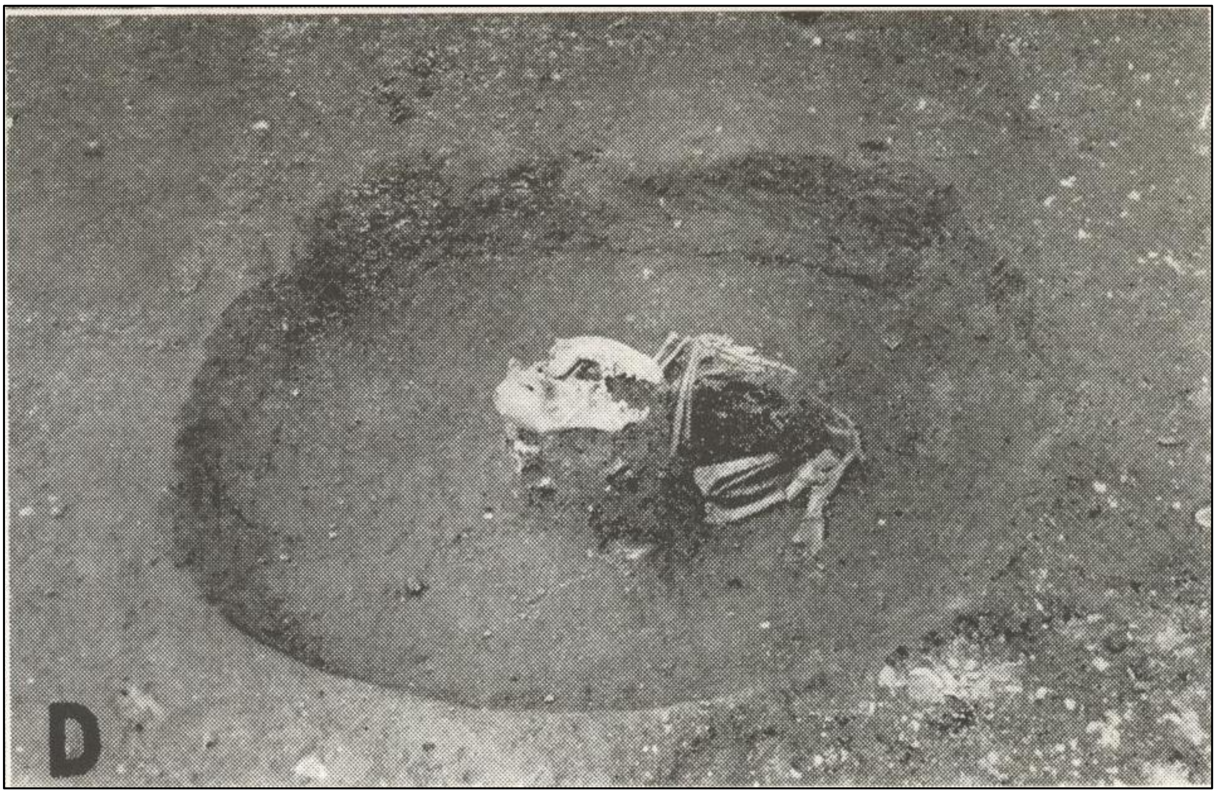


Figure 4.5. An original excavation photograph of an isolated dog burial from the Carlston Annis site, placed in a subsurface soil pit (Webb 1950a)

Read, KY (c. 8,000-3,000 cal B.P., 63 isolated burials)

The Read site, which began excavation in 1937, is a shell midden located on a bluff top some 70 to 80 feet above the Green River in westcentral Kentucky (Fig. 4.1), in the same general area as the Carlston Annis site. The average depth of the site is roughly 4 feet, which included habitation over a considerable amount of time, with the floodplain between the river and the foot of the bluff being inundated in wet years (Milner and Jefferies 1998; Webb 1950b). Dated stratigraphically through projectile point typology, the site has been estimated from 8,000 to 3,000 yr cal B.P., with various radiocarbon dates coming from within that time span (Claassen 1996; Hensley 1994; Herrmann 1996). Like Carlston Annis, all of the dog burials from the Read site come from the Archaic levels, though none have been directly dated. Also, similarly to Carlston Annis, the faunal material at Read is comprised of terrestrial species dominated by white-tailed deer, and plant remains primarily comprised of acorn and hickory nuts.

The isolated dog burial record from Read, with 63 intentionally interred remains, is the largest sample known from the continent. Interestingly, unlike other sites in the Interior Midsouth, there were no dogs buried with humans at Read. Webb (1950b: 360-362) noted that dogs were buried in the same manner as humans at the site, either in small, circular, subsurface pits, or within the shell midden with additionally shell laid over the top (Fig.4. 6).

It is probable that here, like other IMS sites, dogs were valued for their ability to work as a hunting tool, maximizing the taking of white-tailed deer in a densely populated location. Like Carlston Annis, violence with other groups was a problem at Read as well. Here there were 247 human burials, some of which showed obvious evidence for violent perimortem injuries, including two headless, limbless torsos and one individual skull, interpreted as a trophy kill, interred with another body (Claassen 2010; Herrmann 1996). Additionally, there was a human fibula which had been fashioned into an awl, a presumptive trophy item (Morse 1967; Smith 1996; Webb 1950b).

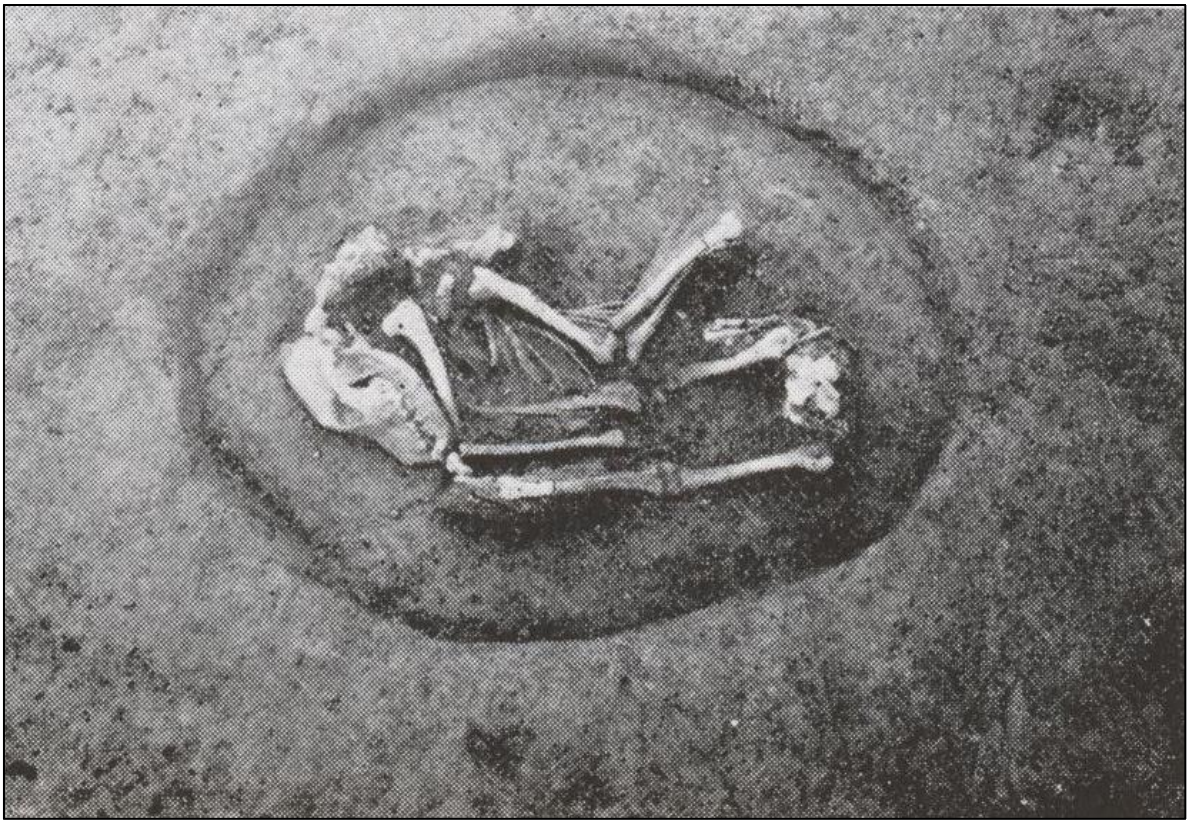


Figure 4.6. An original excavation photograph of an isolated dog burial from the Read site, placed in a subsurface soil pit (Haag 1948)

Eva, TN (c. 6,000-4,000 cal B.P., 14 isolated burials)

The Eva site is located on Cypress Creek near its junction with the Tennessee River in westcentral Tennessee (Fig. 4.1). It lies on an old natural levee on a portion of elevated bottom land and its three components span from the Middle to Late Archaic periods (Lewis and Kneberg 1959; Lewis and Lewis 1947). Lewis and Lewis (1961) have stated that the majority of the isolated dog burials from the site were found in the Three Mile component, which Nance (1986) has dated to 6,000-4,000 yr cal B.P. The analysis of faunal material from the site, performed by Lewis and Lewis (1961), identified mammal bone, particularly that of white-tailed deer as the primary subsistence resource from throughout all three Eva components, and isotopic testing of human bone collagen from the site has confirmed a high reliance on terrestrial herbivores (Tuross, et al. 1994). As at other IMS sites, material from the Eva midden suggests that there may have been additional disturbed isolated burials, as Lewis and Lewis (1961) noted complete dog bones throughout the area. They also noted the inclusion of individual dog elements and teeth in human burials, as well as several complete dogs buried with humans, which were all thought to be males of varying ages. In addition to the dog material and complete dogs buried with humans, there were also 14 isolated dog burials, including one very large dog which had been buried in a curled position with two splinter bone awls and a large stone pick (Fig. 4.7). Similar grave goods had been buried with humans at the site. As at other sites, of the 183 human burials at Eva, some showed evidence of violent trauma, including a male scalping victim (Smith 1995).

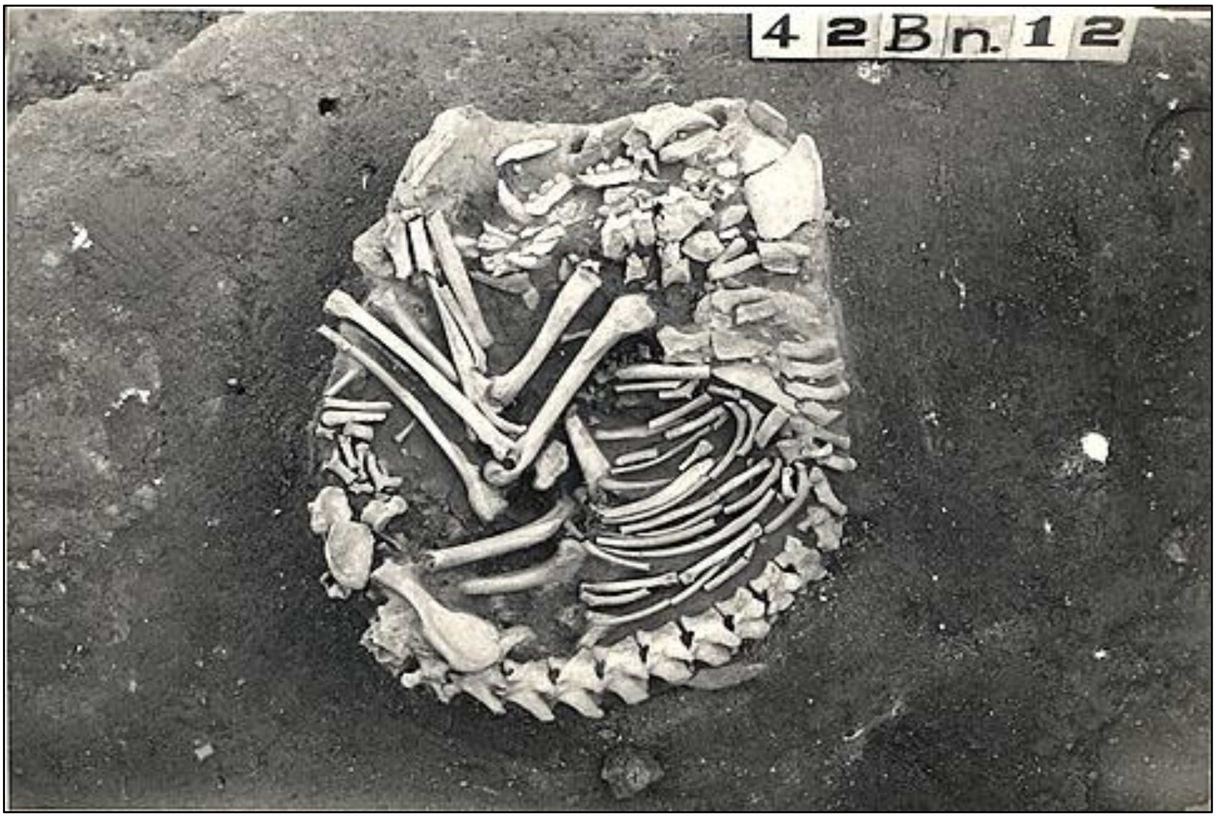


Figure 4.7. An original excavation photograph of an isolated dog burial from the Eva site, Tennessee (Lewis and Lewis 1961)

Discussion

Owing to the unique combination of factors appearing in this region during the early Holocene, researchers have concluded that the culture history of the group are so fundamentally different from the people of the Southern Atlantic coast or other nearby river drainage systems, that it has to be treated separately (e.g. Claassen 1996; Sassaman 1999). Many have argued for increasing social complexity in the Interior Midsouth in the beginning of the Holocene (e.g. Claassen 2010; Sassaman 2004), specifically among the shell midden groups, with Hayden (1996) even offering that dog breeding should be considered a trait of social complexity. The argument for SMA hunter-gatherers as complex, transegalitarian societies is supported by Crothers (2004), among others, who note the tendency towards sedentism, exotic goods, violence, and shell mound cemeteries as monumental territorial markers, as evidenced by the total volumes of some of the sites including Bluff Creek (6,700 m^3), O'Neal (8,000 m^3), Carlston Annis (8,400 m^3), Long Branch (9,600 m^3), and Mulberry Creek (9,600 m^3) (Claassen 2010). By the early Holocene, the colonization of the IMS by hunter-gatherer bands was complete, with increasing competition leaving groups to develop localized technology, reflected in an increasingly intensive use of local resources. These increasing populations would have also lead to the establishment of more permanent communities and fixed social boundaries between group territories and resource patches (Delcourt and Delcourt 2001; Stoltman and Baerreis 1983). Palaeodemographic research by Milner (2004) shows that by the early Holocene, Kentucky had experienced a significant population increase, with Walthall (1980) stating that groups were dealing with increasing demographic packing and territoriality throughout the Middle Archaic, supported by evidence for systematic scavenging and recycling of Early Archaic tools by Middle Archaic people in the Duck River Basin (Amick 1985; Hofman 1986). Further evidence from the end of the Middle Archaic suggests that demographic growth continued, forcing territories to become smaller and populations to become even more tightly packed (Steponaitis 1986).

The increase of concentrated populations in the IMS river valleys, and the establishment of base camps with logistical mobility strategies is supported by a greater focus on white-tailed deer, which was the most important subsistence animal for Archaic people in the eastern woodlands (Madrigal and Holt 2002), specifically those in the interior. Morse (1967) even argued that the phenomenon of the shell mound settlement pattern was partially a strategy focused on establishing winter base camps in anticipation of yarding white-tailed deer. Styles and Klippel (1996) noted a clear change in primary prey animals between the Palaeoindian and Archaic periods, from squirrel to white-tailed deer exploitation, with Neusius (1982) arguing that this greater focus on white-tailed deer was linked to the increasing patchiness of resources, due to a drier climate, which would have increased hunting risk and output requirements as a result of rising populations. Wolverton et al. (2012) have discussed the high fidelity to a home range exhibited in white-tailed deer (see Chapter 7). This fidelity would no doubt be capitalized upon by Archaic hunter-gatherers, making group attachment to a certain territory, strengthened by static aquatic and arboreal nut resources, even stronger. On the other hand, the fidelity to a home range seen in white-tailed deer would also eventually lead to resource depletion in an area with a growing human population, further increasing hunting risk, population pressure, and a dependence upon advanced technologies like hunting dogs in an effort to maximize hunting returns. Warren (2000) has discussed the morphology of dogs from the IMS sites, stating that all are of a similar skeletal structure and size (small to medium), suggesting there may have been trading, interbreeding, and/or preferences for certain types of dogs among prehistoric hunters, as is seen in modern hunters (see Chapter 7). Frequency and patterning of skeletal fractures are also similar among all the dogs, which Warren suggests may be due to encounters with large prey animals. Wobeser (1992) notes similar skeletal fractures in Canadian wolves and coyotes as a result of interspecies conflict with large prey animals, as does Nielsen (1977) for wolves in Alaska. Additionally, Rausch (1967), MacFarlane (1905), Stanwell-Fletcher and Stanwell-Fletcher (1942), Frijlink (1977), Nelson and Mech (1985), and Mech and Nelson (1990) have all noted similar injuries (sometimes leading to death) in wolves and coyotes, presumably inflicted by large ungulate prey, further supporting the conclusion that the dogs intentionally buried at IMS sites had some significant interaction with ungulate prey, likely in the form of hunting.

Coupled with the change in targeted prey species, and an increased benefit in using dogs to track that prey, the IMS also saw a considerable change in projectile points in the early Archaic, which is not surprising as Sassaman (1996) noted that the IMS populations have long been renowned for their innovative improvements to hunting efficiency. Similar to the microliths of the European Mesolithic, and the reduced points of the Japanese Jomon, the projectile points of the midcontinent shifted from the large Clovis points of the Palaeoindian to points significantly diminished in size, which reflect an adaptation to the smaller game species of the postglacial environments (Delcourt and Delcourt 2004; Griffin 1967). Throughout the region, the postglacial lithic industry not only displayed a reduction in size, but also a shift to expedient technology as exotic cryptocrystalline materials were abandoned in favor of poorer quality, but local, materials (Marquardt and Watson 2005; Morse, et al. 1996). At the beginning of the Holocene, group territories were decreasing, while population densities increased, and excursions in search of high-quality lithic material were no longer practical or needed.

Living up to Price and Brown's (1985: 12) assertion that "evidence of violent death appears dramatically among the skeletal remains of more complex foragers", this region is also well known for extensive evidence of skeletal trauma as the result of violence and/or warfare during the Archaic period, presumably due to the shrinking of territories and increased pressure on resources. Claassen (2010) has noted that based on the skeletal record, evidence for violent death and warfare are rampant in the area. In particular, a few IMS sites display violence percentages that are high, even for the Archaic period, in this area. At Ward, which has 16 isolated dog burials, 11.3 % of the human skeletal population showed evidence of violent deaths, while 6.5 % of the Indian Knoll (11 isolated dog burials), and 5 % of the

Carlston Annis human skeletal populations (25 isolated dog burials) showed evidence of violent trauma (Mensforth 1990; Smith 1996; Webb 1946). At the site of Indian Knoll, long known as the site which exemplified Archaic warfare, 4.8 % of the skeletal population was dismembered (Smith 1996; Webb 1946). Additionally, scalping and dismemberment has been identified in the Kentucky Lake reservoir sites (Smith 1993a; b; 1995), decapitation at the Robinson site (Smith 1993b), arm dismemberment at the Big Sandy and Robinson sites (Smith 1993b), possible leg dismemberment at Eva (Smith 1993b) and a headless, limbless torso at Indian Knoll may be evidence of trophy taking (Smith 1996). A possible massacre episode at Cherry includes a young adult male (the male has an inflicted point in one bone), female and several juveniles all put in a mass grave (Smith 1996). Many other dog burial sites also include graves that have presumptive "trophy items" of human remains including Mulberry Creek (Webb and DeJarnette 1942), Bluff Creek (Webb and DeJarnette 1942), Flint River (Webb 1948b), Long Branch (Webb and DeJarnette 1942), Robinson (Morse 1967), Indian Knoll (Webb 1946), Carlston Annis (Webb 1950a), and Read (Webb 1950b). This extensive record of violence and warfare at the sites of many isolated dog burials in the IMS suggests that hunting dogs may have played a vital role in maximizing hunting returns in an increasingly competitive and resource-drained environment.

Conclusion

The climate and environmental changes that were ushered in at the beginning of the postglacial early Holocene were felt throughout the eastern region of the United States, but were particularly significant in the temperate, transitional river valleys of the Interior Midsouth. With the rapid warming and drying, the boreal forests and their accompanying fauna shifted north, allowing a new group of deciduous, hardwood forests, and their temperate woodland species, to quickly colonize. Of these new temperate species, the white-tailed deer came to be the prime target for early Holocene hunters, and an animal that is significantly easier to catch with the help of a hunting dog, which would have chased deer innately (see Chapter 7). As river waters rose shellfish production increased, as did the number of slow backwater ponds and swamps. Hunter-gatherers in the region, seeing the overlapping patches of highly-desirable resources, appear to have quickly established resource territories, marked primarily by large shell midden cemeteries, and maintained semi-sedentary or sedentary base camps near those resources, mainly at the interface between waterway and forest. As populations increased and packed around these static resources, territories shrank and competition became increasingly fierce, as evidence by the high incidence of violence at many IMS sites. Increased competition and pressure for resources would have only solidified the dog's importance as a key hunting tool, as echoed by the increase in both the number of sites and individual isolated dog burials which occurred in the Interior Midsouth.

In the process of creating these large cemeteries, IMS hunter-gatherers buried not only fallen members of their human group, but also many of their dogs. Dogs which show no evidence for butchery, skinning, or other perimortem dispatch, but are instead buried carefully, thoughtfully positioned in prepared pits or in the shell middens. Most of these dogs show skeletal evidence of working lives, with extensive exposure to large prey animals, such as white-tailed deer, while some have been buried with the trappings of a hunter. The important role of the dog in the Archaic hunter-gatherer life has been acknowledged since their burials first appeared. Their earliest excavators first suggested their importance in hunting the white-tailed deer that inhabited the nearby forests, and their careful, human-like burials spoke to their position as a member of the human group. While the record for isolated dog burials in the region starts just after the climatic shift at about 10,000 years ago (Widga, et al. 2012), the practice grew and intensified as the environment became warmer and drier in the IMS, with the peak of activity coinciding with the height of demographic packing, territorial competition, and hunting risk in the Middle Archaic. Not surprisingly, evidence for isolated dog burials is almost nonexistent in the area after the Archaic period, when agriculture came into practice and the importance of hunting diminished substantially. This evidence supports the theory that the phenomenon of isolated dog burials seen across the Interior Midsouth region is due to the very important role hunting dogs played as a) an adaptive tool to hunting a new prey species during the time of environmental transition in the early Holocene, and b) their importance continually increasing as human populations and subsistence pressures demanded maximized returns from each hunting excursion.

Chapter 5: Mesolithic Dog Burials in Northern Europe

Introduction

Since their first identification, the intentional dog burials of Late Mesolithic northern Europe have been considered a cultural phenomenon of note, being particularly well-known from famous sites such as Skateholm in southern Sweden. Though their presence is most commonly associated with Ertebølle-period sites in southern Sweden and Denmark, there are also a number of interestingly similar burials from the Swifterbant site of Hardinxveld-Giessendam Polderweg (hereafter referred to as Polderweg) in the Netherlands. This similarity in the mortuary treatment of dogs from the two areas echoes parallels between the cultures long suggested by scholars (Barker and Gamble 1985; Champion, et al. 1984; Thomas 1996; Zvelebil and Rowley-Conwy 1986a). Both Thomas (1996) and Bogucki (1988) stated explicit links between the two groups, and Louwe Kooijmans (1974) has referred to the Swifterbant as the western variation of the Ertebølle. As such, the burials, sites and cultural practices from these two areas will be considered inclusive throughout this chapter. These groups, which are some of the most well-documented in the world, are noted for their technological, social, and economic complexity, as well as their high levels of sedentism, population densities, and effective use of resources (Andersen 2007; Janik 1998; Price 1985; 1987; Rowley-Conwy 1999; Rowley-Conwy 1983; 2001; Zvelebil 1997; 2008; Zvelebil and Rowley-Conwy 1986b).

Although early on Bailey (1978) argued that very little of Ertebølle nutritional dependence came from aquatic resources, modern fine sieving techniques and dietary isotopic evidence have determined it is a maritime adaptation which characterizes this culture (Ahlström and Molnar 2012; Andersen 2007; Enghoff 1986; 1994; 2011; Enghoff, et al. 2007; Price 1996; Rowley-Conwy 1983). The primary focus of settlement for the Ertebølle was along the coasts, where they exploited the extensive marine resources resulting from warming temperatures and rising sea levels of the early Holocene, as well as nearby terrestrial resources from the dense deciduous forests (Price 1996; Richards 2003). Evidence for a wide range of subsistence procurement tools, including fishing weirs, hooks, harpoons, boats, and variety of projectile points suggests the Ertebølle were exploiting a multitude of resources from both land and sea (Enghoff 1994; 2011). Enormous quantities of hazelnuts, acorn, and other plant products from Ertebølle sites also suggest plant foods may have made important contributions to the diet (Richards 2003). It is this occurrence of overlapping seasonal resources which Rowley-Conwy (1983) has argued made the northern European coastlines ideal locations for sedentary populations. This abundance of resources is also thought to have (Price 1989; Regnell, et al. 1995; Zvelebil 1995) encouraged increasingly dense coastal populations over time, promoting territoriality and violence among neighboring groups (Andersen and Rasmussen 1993; Price 1996; Vang Petersen 1984)

Like the midsouthern United States and eastern Japan, northern Europe saw a dramatic shift in climate and environment in the early postglacial period. The beginning of the postglacial period was marked by a rapid rise in temperature between 5-6 degrees Celsius (Blankholm and Dolukhanov 2008), with the amelioration peaking during the Atlantic period (Fig. 5.3). Following the glacial tundra-steppe of the Younger Dryas period, the region went through a rapid climatic shift during the early Holocene. The Preboreal (c. 10,300-9,500 cal B.P.) saw the influx of birch and pine, with the later Boreal (c. 9500-8000 cal B.P.) increasing in pine and introducing hazel. The Atlantic period (c. 8,000-5,000 cal B.P.) coincided with the Climatic Optimum which included maximum temperatures and the highest sea levels during the late period. This period saw the influx of a dense deciduous forest of oak, elm, lime, beech and hazel, and the rise of the Ertebølle culture, along with isolated dog burials (Zvelebil 2008). These environmental changes also included major shifts in the fauna which local foragers depended on for subsistence, from large herd animals on the open tundra, to smaller boreal species in open pine forests, to quick, medium-sized ungulates in the dense, closed oak-based forests of the Ertebølle period. It is during this period, with the ushering in of the dense Atlantic forests and significant rise of sea levels, that the isolated burial of dogs begins throughout southern Sweden, Denmark, and the Netherlands. The Subboreal period that followed the Atlantic saw a shift to a cooler, more arid climate which increased conifers, making for a more open mixed forest. It is during this time that hunting dependence decreased and agricultural subsistence began, a transformation that started much later in northern Europe than it had in nearby regions (Zvelebil and Rowley-Conwy 1986a).

Louwe Kooijmans (2009) has suggested that the intentional burial of dogs throughout this region indicates they clearly had a special status within the culture, with Bradley (1998) proposing dogs were treated as individuals in their own right, and Hatting (1993) stating that the dogs from the Danish sites were likely used as hunting dogs, a suggestion which is no doubt likely for all the northern European isolated dog burials. Though currently the number of Mesolithic sites in northern Europe which include isolated dog burials is fairly low, with six sites containing fifteen total burials, Larsson (1990a) has argued that isolated dog burials were likely a much more common occurrence than is documented. He suggested that due to preservation issues, shallow dog burials which have been disturbed by the original occupants or later agricultural plowing, the number of actual isolated dog burials is significantly underestimated. This theory is supported by the regular finding of complete, intact, unprocessed clusters of dog bones from a number of other northern European sites, including Segebro (Lepiksaar 1982), Dyrholmen (Degerbøl 1933), Vedbaek-Boldbanner (Aaris-Sørensen 1977), and Sjöholmen (Dahr 1937; Fig. 5.1). These examples are just a few of the possible isolated burials that may have been part of the living record. As a result, I have included these examples in this chapter as potential burials, in addition to the fifteen burials previously noted (Table 5.1).

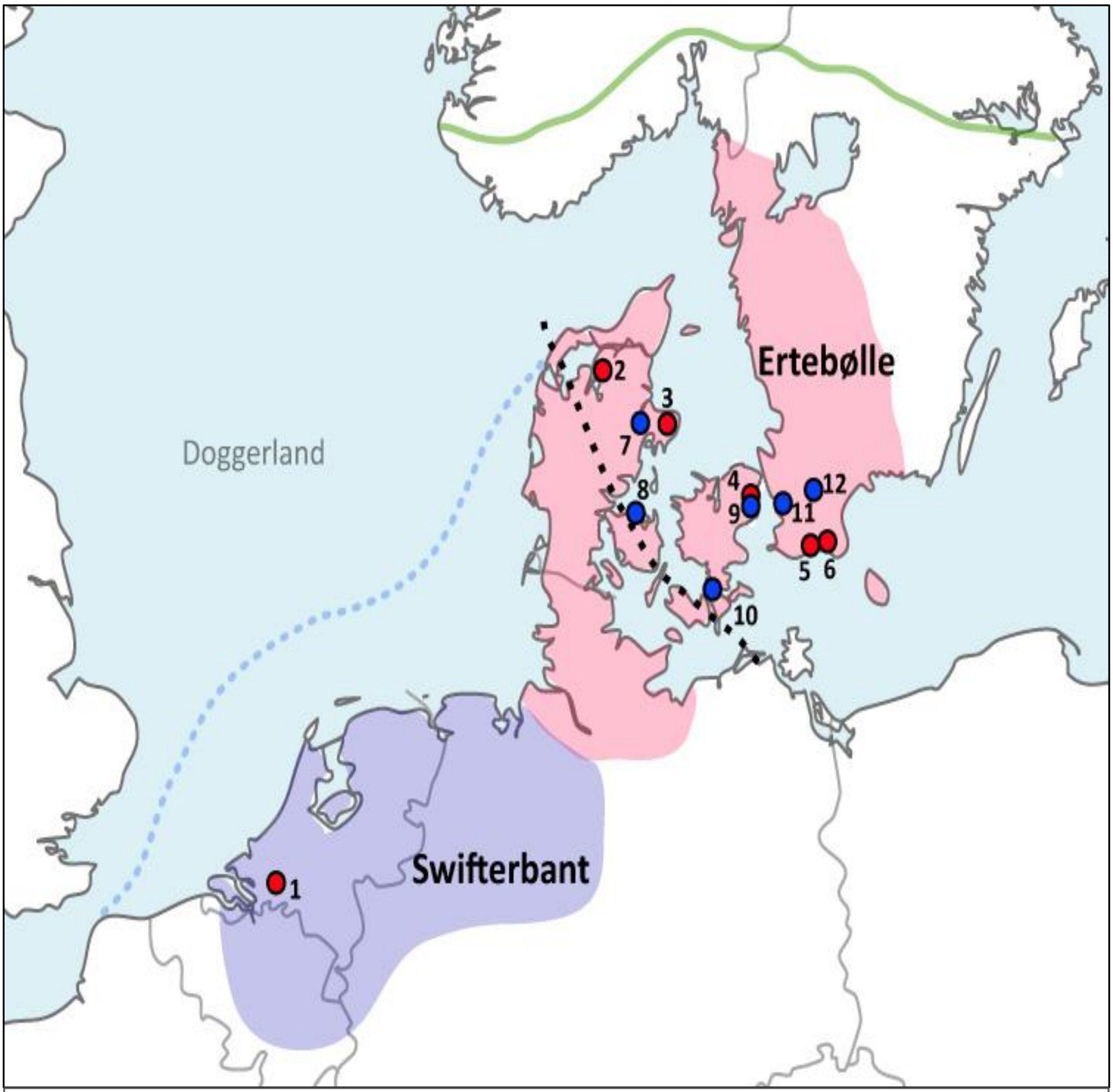
Site	Date	# of Burials
Vedbaek-Gøngehusvej 7	**c. 7,700-7,500 cal B.P.**	**1**
Polderweg	**c. 7,500-7,300 cal B.P.**	**3**
Skateholm	**c. 8,000-6,000 cal B.P.**	**7**
Ertebølle	**c. 7,000-6,300 cal B.P.**	**1**
Bredasten	**c. 6,500-6,000 cal B.P.**	**1**
Nederst	**7th Millennium BP**	**2**
	total	**15**
Segebro	c. 7,400-6,900 cal B.P.	
Argus Bank	c. 7,080-6,870 cal B.P.	
Dyrholmen	c. 6,680 cal B.P.	
Vedbaek-Boldbanner	c. 6,510 cal B.P.	
Agernaes	c. 5,600-5,100 cal B.P.	
Sjöholmen	Ertebølle	

Table 5.1. Confirmed isolated dog burials from northern Europe (bold) and additional possible isolated burials

Figure 5.1. Partial intact dog remains from the Sjöholmen site in southern Sweden, a possible isolated burial (photograph: Peterson 2006)

Location

The geography of northern Europe makes for a complicated picture when attempting to reconstruct past lives in prehistory. Low lying terrain and significant sea level rise in the early postglacial period means that a majority of the early and middle Mesolithic coastal settlements are now submerged (Fischer 1997; Larsson 2007). Fischer (1995) showed that there are no coastal Maglemose sites found above the present sea level, and that the majority of Kongemose and Ertebølle coastal sites are likely underwater as well. Rapidly rising sea levels after the '8.2k event' meant a flooding of the land area between Denmark and Britain, often referred to as Doggerland, but now the location of the North Sea (Fig. 5.1). In addition to this massive sea level rise event, isostatic rebounding of the land left certain areas to continue sinking further underwater, while others are rising. Denmark currently tilts on a NW-SE axis which leaves Ertebølle coastal settlements in the north and northeast accessible, but those from the south and southwest submerged (Andersen 1995; Blankholm 2008). It is unsurprising then that it is the northeastern part of this region which encompasses the majority of Ertebølle sites and every Ertebølle isolated dog burial or potential dog burial (Fig. 5.2). This further supports the assumption that Ertebølle isolated dog burials are likely not as low in numbers as this data suggests, just that their discovery is hindered due to their association with coastal Ertebølle sites which are submerged throughout Doggerland.



1: Hardinxveld-Polderweg
2: Ertebølle
3: Nederst
4: Vedbaek-Gøngehusvej 7
5: Skateholm
6: Bredasten
7: Dyrholmen
8: Agernaes
9: Vedbaek-Boldbanner
10: Argus Bank
11: Segebro
12: Sjöholmen

Figure 5.2. Map of northern Europe showing the extent of the Ertebølle and Swifterbant complexes, confirmed isolated dog burial sites (red dots), additional possible isolated dog burials (blue dots), the northern extent of the temperate Atlantic forests (green line), the coastline at 8,000 cal B.P. (blue dotted line), and Denmark's tilt axis (black dotted line) (data from Andersen 1995 and Blankholm 2008)

Even given this hindrance, the majority of identified Ertebølle sites have been found along the coasts, where Rowley-Conwy (1983) argued foragers made great use of overlapping marine and terrestrial resources while living in primarily sedentary settlements. Andersen and Johansen (1986) and Thorpe (1996) later supported the suggestion that stable coastal Ertebølle settlements with a degree of territoriality were the result of a productive subsistence exploitation pattern which maximized resources from both land and sea. Thorpe (1996) has further substantiated this theory by noting that there are few Ertebølle sites located outside of the best coastal niches, while Fischer (1995) has highlighted the substantial differences between inland and coastal Ertebølle sites, stating that coastal sites outnumber other sites in quantity and size of sites, artifact density, and structural features. It is clear that the Ertebølle, like the Jomon in Japan and Archaic groups of the midsouthern United States, were highly adapted to life on the coasts or major river systems. Andersen (1995) has added that like the North American and Japanese case areas, sea level rise and warming temperatures in northern Europe extended the coastline and created numerous shallow, saline estuaries which supported a rich marine food chain with high biodiversity, stability and bioproductivity. This productive aquatic resource area, paired with ungulate prey and edible nut supplies from nearby deciduous forests, made coastal settlements ideal locations for sedentary Ertebølle populations. Unlike the other regions discussed in this thesis, the Ertebølle dog burials, and in fact the Ertebølle way of life itself, was not solely associated with shell middens. While two of the sites with isolated dog burials, the eponymous Ertebølle site and the Nederst site, are located on shell middens, the other sites are not. Thorpe (1996) has suggested that the lack of shell middens is a result of their low survival rate due to erosion on the Atlantic coast, but also the uneven distribution of natural shell beds throughout northern Europe, where they are primarily found only in north and east Jutland due to the problematic low saline content and cooler waters of the Baltic. Nevertheless, Thorpe (1996) has stated that other than the inclusion of shell, the shell midden sites are identical to the other shell-free coastal Ertebølle sites in form and function.

Palaeoenvironmental Reconstruction

During the early Holocene postglacial period, northern Europe saw a rapid shift in successive climates and environments, which would have made an enormous impact of the settlement and subsistence of the local forager populations, demanding a high degree of adaptivity (Eriksen 1996; Fig. 5.3). By 14,000 cal B.P. both Denmark and southern Sweden had been deglaciated (Bratlund 1996) and a steppe-tundra environment spread across the region, later followed by a sparse birch and willow forest with sedges and grasses (Eriksen 1996; Jochim 2002; Larsson 1991; Price 1991). These tundra environments were inhabited by large herd animals, such as reindeer and horse, which the archaeological record shows local foragers were targeting with large tanged points (Jochim 2002). The Late Pleistocene record from Denmark in particular shows very high levels of reindeer dependence, with some elk and aquatic birds as well (Eriksen 1996). After the Younger Dryas period climatic warming encouraged the disappearance of the tundra, with an influx of open preboreal forests of increasing birch and pine, as well as growing populations of auroch and elk. As the environment continued to warm and become drier, more boreal elements pushed north into northern Europe, including increasing pine and aspen, as well as hazel, alder, and elm which are thought to have expanded across the region in less than 500 years (Bennett 1983).

Although there is an increase in elk utilization from across the region, reindeer continued to be an important resource, as determined by the high number of remains and pine wood arrows found from around 10,000 cal B.P. at Stellmoor in northern Germany (Clark 1975).

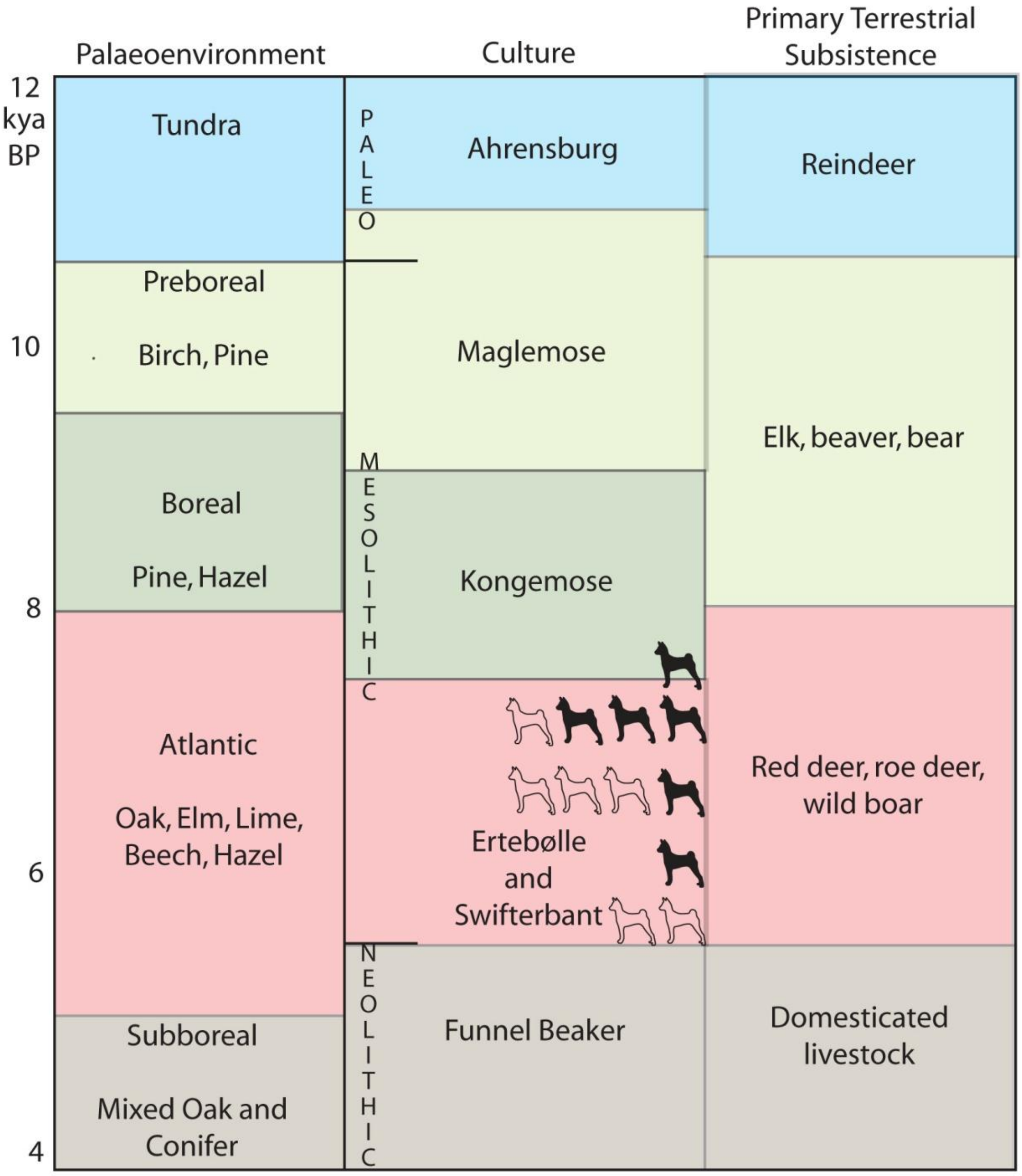


Figure 5.3. Associated palaeoenvironments, culture groups, and primary terrestrial subsistence species in northern Europe from 12,000-4,000 years ago. Timing of sites with confirmed isolated dog burials (bold) and possible isolated dog burials (outline) are indicated, where each icon represents one site.

By after 9,000 cal B.P. the distribution of the species of northern Europe was essentially modern, yet the composition was not. Berglund and Larsson (2003) have noted that between 6,000-5,200 cal B.P. temperatures were warmer than modern times, with summer temperatures averaging around 2 degrees Celsius above today. The environment continued warming and precipitation increased, supporting the continued arrival of new deciduous taxa which formed the dense Atlantic forest, dominated by oak, lime, ash, beech, elm, and hazel, many of the nuts of which were important to Mesolithic foragers (Blankholm 2008; Grøn and Skaarup 1993). These larger trees were joined by a dense understory and shrub layer comprised of species such as spindle tree, alder buckthorn, and guelder rose (Berglund and Larsson 1991). Density of the Atlantic forest is further supported by pollen from Holmegaard bog on southern Zealand which shows high dominance of arboreal pollen, as opposed to pollens correlating to more open environments (Aaby, et al. 1988). With this change in environment came a marked and rapid change in forest species as well – from large herd animals such as reindeer and horse, to quicker, more solitary species of deer and wild boar. Many scholars have noted the difficultly that must have been encountered by Ertebølle populations navigating these changing environments. Roberts (1998: 109) in particular noted, "as resources for human exploitation these animals were more dispersed and less visible in the forest than the concentrated, easily culled fauna of the Late Glacial tundra." He went on to suggest that the dense forests would have posed significant hindrances to human travel, and specifically hunting visibility, and proposed that the new trapezoidal microliths found in southern Sweden from around 8,000 cal B.P. (Larsson 1978) would have been ideal for bleeding out forests ungulates based on a dense forest, short-range hunting methodology. Most importantly, Roberts (1998) suggests that domestic dogs must have been an important factor in this dense forest hunting strategy.

In addition to changing land environments, the sea was changing as well. Early Holocene glacial melting led to significant sea level rise across northern Europe, including the flooding of Doggerland and many coastal early Mesolithic sites, which are now covered by the North Sea (Berglund and Larsson 1991; Larsson 1983). While sea levels averaged about 60m lower than the present around 10,000 cal B.P., by 5,000 cal B.P. they had reached or exceeded modern levels (Price 1991), with estimations that levels rose over 30m alone between the late Preboreal and Atlantic periods (Jelgersma 1979). Similarly to North America and Japan, this sea level rise increased coastlines, flooded inlets, which created rich saline estuaries, and increased overall aquatic bioproductivity (Grøn 1998). While the sea continued to rise until around 5,000 cal B.P., vegetation stayed stable throughout the Atlantic period until 5,800 cal B.P. when there was an increase in hazel and ash (Aaby, et al. 1988). This change immediately preceded a cooling period, called the Subboreal, which began after 5,000 cal B.P. Around the same period there was a significant decline in elm, likely caused by disease, paired with a rapid cultural change, which saw the rise of the Funnel Beaker culture and the introduction of agriculture (Price 1991), a radical change which Grøn (1998) suggests may have happened within the space of 100 years.

Burials

Unlike the considerable isolated dog burial records found in North America and Japan, the Mesolithic isolated dog burial record is fairly small, likely due to the issues of preservation and sea level rise previously discussed. I have identified fifteen individual isolated burials from six archaeological sites spanning throughout the Ertebølle period (Tab. 5.1). Three of these sites, Nederst, Ertebølle, and Vedbaek-Gøngehusvej 7, are located in Denmark. Two sites, Skateholm and Bredasten, are located in Sweden, and one site, Polderweg, is located in the Netherlands. I have also included the four additional sites in Denmark and two additional sites in Sweden which have complete dog skeletal material which may be from possible isolated burials (Larsson 1990b). As noted by Jonsson (1988), it is probable that many isolated dog burials have been overlooked in the excavation of Mesolithic sites in northern Europe, specifically those from which a high number of clustered, intact dog bones are found (e.g. Lepiksaar 1983). The sites which contain isolated dog burials in northern Europe share numerous traits with isolated burial sites in the United States and Japan, including a proximity to both aquatic resources and dense deciduous forests, coastal settlements, increased sedentism, rapidly rising populations, evidence for territoriality and violence, and a significant subsistence dependence on forest ungulates. As is seen from sites with isolated burials in all the regional areas discussed in this dissertation, deer and/or boar are the prey species in highest abundance at every isolated dog burial site in northern Europe.

Two of the most well known sites with isolated dog burials from northern Europe are Hardinxveld-Polderweg in the Netherlands (Fig. 5.2) and the Skateholm complex in southern Sweden (Fig. 5.2). Polderweg is a Swifterbant site dated from between 7,500-7,000 cal B.P., contemporaneous with the early and middle Ertebølle period. Pollen data from the sites shows a temperate deciduous environment dominated by oak, elm, ash, and lime, but also a significant understory and shrub layer which would have made the forest very dense and particularly difficult to take prey in without the assistance of a hunting dog (Kooijmans 2000). Interestingly, Göransson (1988) noted that many early researchers presumed the dense primeval forest was an obstacle and enemy to Mesolithic populations, yet he suggests the broadleaved forests would have contained the greatest terrestrial resources available. This dichotomy of the temperate forest as a place of rich resources, yet an impenetrable barrier further supports the theory that dogs were an indispensable tool in the hunting of deciduous forest fauna. Faunal remains from the site indicate that wild boar, an animal that is dangerous and much easier to hunt with the assistance of dogs (see Chapter 7), was the primary terrestrial subsistence species, with red deer, roe deer, beaver, and otter also being important. A high proportion of fish remains, isotopic analysis, and the coastal settlement location suggest the inhabitants were utilizing a mixed terrestrial forest-estuarine practice, as there is a complete absence of any kind of domesticate (Kooijmans 2007; Smits and van der Plicht 2009). There are several small cemeteries at Polderweg, all containing Swifterbant-period human remains in a prostrate position and mostly without grave goods, suggesting the population were likely transegalitarian (Kooijmans 2009). Some of the remains from the site also show evidence for violence, trophy-taking, and warfare, including isolated human skulls and a clavicle with perimortem cut marks (Smits and van der Plicht 2009).

The three isolated dog burials that were excavated from Polderweg, which are all dated from the earliest phase, suggest a special status and close bond between humans and dogs within the group (Kooijmans 2001; 2005; 2009). This relationship, and the obvious careful treatment of some dogs from Polderweg, is particularly interesting given the treatment of dogs at other nearby Dutch locations. At the sites of Rijswijk and Schipluiden, both of which were only about 40km from Polderweg, there are no isolated dog burials, and dogs were clearly being butchered and probably sacrificed for ritual purposes. The two sites are dated to the very beginning of the Neolithic period, just after the Swifterbant phase, and represent the apparent significant shift in attitude towards dogs. Both sites maintain agricultural subsistence and a dependence on domesticated animals, which Louwe Kooijmans (2009: 41) has highlighted by noting that “hunting was of no importance whatsoever” at the sites. While the dog burials at Polderweg were complete and carefully prepared (Fig. 5.4), dog remains from the early Neolithic sites are often represented by individual severed skulls, headless bodies dumped as rubbish, and individual elements in special ritual pits (Fig. 5.4). This rapid change in the treatment of dogs clearly mirrors the change in subsistence practices from a dense forest strategy to agricultural and domestic animal dependence, with the diminishing importance of dogs paralleling the decline of terrestrial hunting.

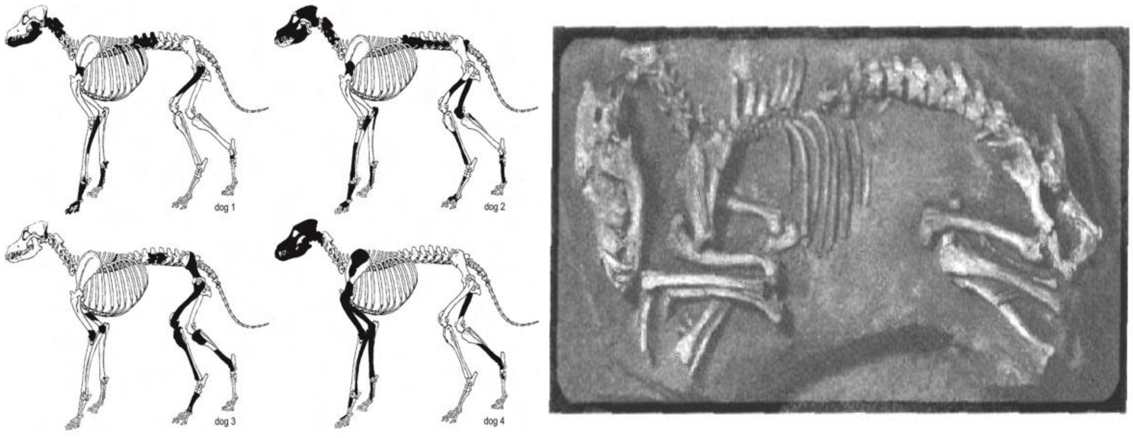


Figure 5.4. Comparison between the excavated individual dog elements identified as sacrifice or ritual rubbish from the early Neolithic Dutch agricultural site of Schipluiden (left), versus the careful isolated burial of a dog from the nearby late Mesolithic Dutch forager site of Polderweg (right) (drawing and photograph: Kooijmans 2009)

The most well known of isolated dog burials in northern Europe are those from the Skateholm complex in Scania, southern Sweden. Skateholm is made up of three main sites, only two of which, Skateholm I and II, have produced any human or faunal remains. All the sites date from the late Mesolithic period between 8,000-6,000 cal B.P., and they are located on a lagoon near the coast, utilizing both aquatic and terrestrial resources (Larsson and Lundmark 1989). Like Polderweg, the Atlantic temperate forests surrounding the site were dominated by oak, lime, elm, and ash with a dense understory of ivy, bracken, and ferns (Gaillard, et al. 1988; Goransson 1988). These dense woods were inhabited by wild boar, red deer, and particularly roe deer, which Jonsson (1988) noted would have been particularly attracted to the forests around Skateholm. Faunal remains from the sites support these prey species as the most commonly hunted terrestrial animals (Jonsson 1988; Larsson and Lundmark 1989; Mithen 2006), though there is marked increase in the hunting of wild boar between the first and second phase, which correlates to an increase in isolated dog burials between the phases as well. These increases may be associated with the importance of hunting dogs in the taking of dangerous wild boar.

The cemeteries from the Skateholm phases have yielded a significant number of both human and dog remains, with 85 human skeletons and seven dog skeletons between them (Fahlander 2008). While the inhabitants of Skateholm are thought to have been transegalitarian, Mithen (2006) has suggested that a relative social status was related to the hunting of terrestrial ungulates at the site. He noted that the high proportion of boar and deer teeth included in burials, which is also seen at the site of Vedbaek-Gøngehusvej 7, is paradoxical as these complex hunter-gatherers develop on coastal regions to exploit coastal resources, yet clearly ascribe status and importance to terrestrial ungulate exploitation. This observation is important for the relationship between humans and hunting dogs at all the coastally-adapted complex forager groups discussed throughout this dissertation. The value ascribed to dogs at Skateholm, evidenced by elaborate burials equivalent to human males at the site, has been noted by numerous researchers (e.g. Bradley 1998; Fahlander 2008; Jonsson 1988; Larsson 1990b; Larsson and Lundmark 1989). While Larsson and Lundmark (1989) have suggested the dog burials are examples of cenotaphs, replacements for their missing human masters, the prevalence of this phenomenon throughout the northern Europe and other complex forager groups around the world suggest that the burials are much more likely the result of an increased status of hunting dogs, due to their indispensableness to a dense forest hunting strategy. This importance is reflected in one Skateholm dog burial, which is considered the richest of all graves at the site, dog or human, and included red ochre, red deer antlers, flint blades, and a unique ornamented bone hammer (Fig. 4.5). These occurrences led Jonsson (1988) to suggest that dogs at Skateholm must have been highly valued, an attribute supported by Larsson (1990a), who stated that the inhabitants of Skateholm showed "a surprising degree of reverence for certain dogs", and Bradley (1998) who further proposed that dogs Skateholm were treated as individuals in their own right.

Figure 5.5. An isolated dog burial from Skateholm, southern Sweden. The inclusion of flint blades near the pelvis, red deer antlers along the spine, and an ornate bone hammer make this the most highly-adorned burial from Skateholm, dog or human (photograph: Lars Larsson)

Discussion

One of the most critical changes for Mesolithic populations in the postglacial world must have been the significant shift in prey species due to rapid environmental change. In the late Palaeolithic and early Mesolithic, large herd animals such as reindeer, elk, and horse populated the tundra and open forests, which Møller Hansen et al. (2004: 80) have described as "roam(ing) for the benefit of hunter-gatherers". This description imparts an image of Maglemose hunters of northern Europe being unhindered by the surrounding environment, which allowed for long-range targeting and advantageous, unobstructed views of prey. By comparison, the dense forests of the middle and late Mesolithic introduced more solitary, quicker ungulate prey and decreased sensory awareness of the environment, increasing hunting risk throughout northern Europe. The deciduous tree nuts and small foraging herbs and plants which were utilized by Mesolithic human populations were also very important food items for the roe deer, red deer, and wild boar that inhabited the temperate forests (Eriksen 1996; Grøn and Skaarup 1993; Jedrzejewska, et al. 1994; Jonsson 1988). The very large body size of Mesolithic boar suggests that the Atlantic forests were particularly favorable for their flourishing, with high proportions of masting oak trees contributing to their acorn-dependent diet (Magnell 2006).

As temperatures warmed through the Mesolithic, deciduous forests continued to spread and sea levels rose even higher, creating rich, productive aquatic resources along the coastlines. Many researchers (e.g. Grøn 1998) have argued that this change in resource structure – the increase in highly productive coastlines – encouraged coastal sedentism. Though settlement was coastally located, terrestrial ungulates continued to be an important subsistence species for both Ertebølle and Swifterbant groups (Raemaekers 1997), with shellfish offering little in the way of caloric value (Bailey 1978) and forest ungulates making up over 90% of the meat consumed by these Mesolithic populations (Zaliznyak 1998). In addition to terrestrial forest ungulates, Ertebølle and Swifterbant populations were also highly dependent on fish as one of their main resources (Enghoff 1994; 2011; Rowley-Conwy 1999). While the large Bromme points found during the Late Glacial across northern Europe confirm the importance of hunting large game during that time (Fischer 1991), smaller, elaborate projectile points and microliths were characteristic of the Ertebølle period, which Richards (2003) has argued represent the archaeological signature of a technology developed to meet the demands of resource stress. Analysis of Kongemose and Ertebølle microliths by Friis-Hansen (1990) shows they had a high cutting index and were designed to cause massive bleeding, ideal for tracking ungulates with hunting dogs through a dense forest. Numerous researchers have posited that dogs were a critical element to Mesolithic ungulate hunting in northern Europe (e.g. Magnell 2006; Perri 2010; Price 1991; Skaarup 1995), with Magnell (2006) suggesting hunting dogs were indispensible to the dangerous hunting of wild boar, which require baiting and close-contact strikes to kill (see Chapter 7).

While hunting dogs were likely useful to Ertebølle and Swifterbant hunters, they may have become even more necessary as rising human demographics put increasing pressure on terrestrial prey populations. Across the region there is evidence for increasing hunting pressure on deer and boar through the late Mesolithic. Unsurprisingly, apparent increases in hunting pressure correlate to increases in isolated dog burials, suggesting the valuation and mortuary treatment of hunting dogs was related to their importance in dense forest hunting strategies. At Skateholm, the site with the highest number of isolated dog burials in the region, there is evidence for significant pressure on terrestrial game resources, as almost all ungulate faunal remains were broken for marrow or brain extraction (Jonsson 1988). While deer are hunted in high numbers in the earlier phase of the site, roe deer numbers are reduced to less than half in the later phase, when the more dangerous wild boar are being killed at very high percentages (Jonsson 1988). Age structures of red deer from Skateholm and other Ertebølle sites suggest high hunting pressure also, as few individuals were aged over five years. Similarly, wild boar remains from nearby Bredasten show a high number of adults and females, indicating increased hunting pressure and little concern for management or sustainability of the population (Magnell 2006). Likewise, Noe-Nygaard (1974) documented a high percentage of healed wounds from Ertebølle ungulate bones, up to 87% at some sites, suggesting repeated attacks on the same individuals and overexploitation of local ungulate populations. Zaliznyak (1998: 48) suggested this evidence represents “a deepening crisis in Mesolithic forest hunting”, which resulted in Ertebølle groups overhunting ungulate populations and permanently affecting their basis of the subsistence economy. In an effort to mitigate the effects of diminishing prey populations, rising human populations, hunting pressure and risk, Ertebølle foragers likely increasingly employed hunting dogs to improve hunting prowess and guarantee higher hunting returns.

The possibility that populations, subsistence pressure, and thus territoriality were growing throughout the Mesolithic period is supported by the occurrence of cemeteries and violent trauma among Ertebølle groups in the region. While early Mesolithic people seem to have maintained mobile, seasonal settlement patterns, by the Kongemose period populations appear to have moved towards larger households with multiple family units. Decreasing distances between these individual groups would have increased confrontation and intergroup violence (Grøn 1998).The appearance of heavy pottery and cemeteries in the later Mesolithic suggest increasing sedentism and control of resources, as ethnographic studies show cemetery-using groups are likely to be territorial (Pardoe 1988; Rowley-Conwy 1998b; Thorpe 1996). A strong degree of territoriality in Ertebølle groups has been supported by numerous researchers (e.g. Berglund and Larsson 1991; Grøn 1998; Price 1991; Rowley-

Conwy 1998b; Thorpe 1996), with Thorpe (1996) even drawing parallels between the violence observed from Ertebølle cemeteries and that from the shell mound groups in the midsouthern United States. Bennike (1985) noted a high percentage of cranial traumas, in the form of fractures and impressions, from skeletal remains across Mesolithic Denmark. Indications of warfare and ritual post-mortem treatment of corpses are well known from the late Mesolithic record of the region (Albrethsen and Petersen 1975; Bennike 1985; Grøn and Skaarup 1993; Richards 2003; Skaarup 1995), with isolated dog burials sites displaying remarkable examples of violence. At Skateholm an arrowhead was lodged in the pelvis of a male skeleton (Larsson and Lundmark 1989), and a bone point found in another male skeleton (Vencl 1991). Trauma from the Vedbaek sites is even more pronounced, where there is significant evidence for conflict and warfare. Of the 22 human remains excavated, one adult male was found with a bone point in his throat (Albrethsen and Petersen 1976; Bennike 1985; Price 1991) and a 40-year-old woman, found in a double grave with a 5-year-old child, had a healed cranial fracture from a blunt instrument (Brinch Petersen, et al. 1993). The mass burial of an adult male and female with a child also suggests violent death (Albrethsen and Petersen 1976). This increased violence in the late Mesolithic is likely the result of territoriality and resource pressure due to increasing populations (Blankholm 2008; Larsson 1988; Meiklejohn and Zvelebil 1991; Newell and Constandse-Westermann 1984; Newell, et al. 1979; Price 1985; Welinder 1982). Berglund and Larsson (1991) have argued that the very existence of late Mesolithic cemeteries indicates the demarcation of territories and conflict between communities. The resource pressure felt by late Mesolithic populations likely increased as populations grew larger and closer together, terrestrial resources became increasingly strained, and climatic fluctuations decreased productivity of aquatic resources (Larsson 1987). These stresses may have contributed to the dramatic shift in diet observed with the influx of agriculture in Neolithic Denmark (Richards 2003).

It is likely that the careful, intentional dog burials observed in the Mesolithic period of northern Europe are the result of increased valuation of the dog as an irreplaceable hunting tool. Their importance as a dense forest hunting adaptation seems apparent by the early Mesolithic, and their usefulness probably amplified as populations and resource pressures increased, forcing forager groups to minimize hunting risk and maximize hunting returns. The value of Mesolithic hunting dogs has not been lost on earlier researchers. Riede (2011) has noted that the use of dogs was not part of the cultural repertoire of Late Glacial reindeer hunters because their use did not provide an advantage in reindeer procurement, and Eriksen (1996) suggested dogs were likely a very important part of a dense forest hunting strategy, "an almost invaluable hunting companion" (Eriksen 1996: 119), including possibly carrying meat back to camp. In fact, Eriksen's (1996: 119) insight that in the Mesolithic the dog "should rather be regarded as a weapon, and the act of domestication may be likened to the introduction of a new technology" further supports the idea that dogs were useful to the Ertebølle, as well as other temperate deciduous forest foragers, as a technological innovation in adapting to dense environments and new prey species. Eriksen (1996: 119) goes on to suggest that dog remains are found earlier in this region of northern Europe than in other parts of northern and central Europe because "apparently not everyone was in need of this new development." This concept, that the use of hunting dogs is a specific adaptation to early temperate forests environments and prey species, is applicable to not only the Scandinavian record, but also the record in the midsouthern United States and eastern Japan, where isolated dog burials are absent from adjacent regions. Furthermore, the intricate burial of dogs in these areas suggests their role in hunting success afforded them an increased social position in the group (Hawkes, et al. 2001; Holmberg 1969; Magnell 2006), a correlation which has been observed among sedentary hunting populations (Kent 1989).

Conclusion

As observed in the midsouthern United States and eastern Japan, the climatic and environmental prehistory of northern Europe had significant effects on early postglacial foragers in the region. Increasing climatic warming after about 12,000 years ago ushered the region through a series of successive environmental types and accompanying fauna, including tundra-steppe with reindeer, preboreal and boreal forests of birch, pine and hazel with elk, and eventually the temperate deciduous oak-dominated forests with deer and wild boar. With these changes in forest and fauna came cultural changes in the foraging groups who inhabited the area. As forests grew denser and became populated by quicker, more solitary ungulates, hunting technology changed as well. While human groups of the Late Glacial were at an advantage hunting sizeable reindeer herds on the open tundra, using large bifacial points to deeply penetrate their prey, Ertebølle and Swifterbant hunters of the later Mesolithic were significantly disadvantaged in hunting the smaller ungulates of the deciduous forests. Dense undergrowth and a multi-layered canopy meant that human senses were severely limited in this environment, giving prey ample opportunity to hide or escape undetected. In order to mitigate this disadvantage, Mesolithic foragers developed advanced weaponry designed to suit the environment and prey species, specifically the microlith, bow and arrow, and hunting dogs. While the bow and arrow allowed foragers to target prey at short ranges in dense forests, microliths were designed to cut large, bleeding wounds, which hunting dogs could then track, regardless of forest thickness or undergrowth. This combination of technology, especially the use of hunting dogs, reduced the shortcoming of the human senses, minimizing hunting risk and maximizing hunting success for deer and boar.

As the climate continued to warm and the temperate forests expanded and became denser, the sea level began to rise, forming rich, productive estuaries and extending coastlines. As they did at the banks of the larger midcontinent rivers of the United States and the coasts of eastern Japan, Mesolithic foragers took advantage of the abundant, static aquatic resources along the coastlines of Denmark, southern Sweden and the Netherlands by forming sedentary communities. While these groups utilized the shellfish and fish resources on the coast, the majority of their diet depended on the terrestrial meat, deer and boar, hunted from nearby temperate forests. As populations grew through the Mesolithic, cemeteries formed as a display of territoriality and groups clashed, as evidence from violent trauma seen on the bones from many Ertebølle graves. Extensive animal bone processing, increasing utilization of the dangerous wild boar, evidence for repeated attacks on individual animals, and changing prey species age profiles indicate that growing populations were having an effect on terrestrial resources, increasing hunting risk and resource pressure. Paired with these increasing pressures was the increasing number of dog burials from Ertebølle sites. This suggests, as observed in both the United States and Japan, dog burials began when the value of dogs as critical hunting tools, and perhaps equivalent members of the social group, was recognized in the early Ertebølle period, and grew in number as they became increasingly vital to maximizing hunting returns from an increasingly depleted temperate forest.

Chapter 6: Jomon Dog Burials in Eastern Japan

Introduction

The Jomon culture of prehistoric Japan, defined by its large sedentary groups, innovative hunting adaptations, early forms of pottery, protracted practice of foraging subsistence strategies, and careful dog burials, is one of the most prolific and successful complex hunter-gatherer groups from the prehistoric period. Yet, while western-language publications on the Jomon period have increased in recent years, the total number is still very low in comparison to most other regions of the world. Many researchers (e.g. Akazawa and Aikens 1986; Rowley-Conwy 1984) have noted that despite much interest, very little information about prehistoric Japanese archaeology is available to the international community, and Habu (2004) has reiterated that this continues to be a problem, as most Jomon research is published in Japanese only. This is disappointing, as research from the Jomon period may have implications for understanding temperate region foragers in both northern Europe and North America (Rowley-Conwy 1984). The research presented in this chapter is an amalgamation of information available from English-language sources and translated Japanese material. The data presented here and in Appendix 3 is a result of laboratory and field research at Nara National Research Institute for Cultural Properties (Nara, Japan) and other locations throughout Japan. This research included an extensive review of the grey literature, with the first western-language translation of the majority of the material, as well as the analysis of dog burial remains, and field observation of dog-assisted hunters.

The first identification of many Jomon-period archaeological sites began with large-scale land development in Japan during the 1960's, leaving countless Jomon sites to be excavated as rescue archaeology or commercial resource projects. This period of high-development and low archaeological priority left many of the archaeological reports severely limited in their findings. Habu (2004) noted that the quick proliferation of data, due to massive amounts of excavation, meant further research into quantitative records from, for example, flora and fauna remains was often neglected. This chapter presents data from those sites which contain the information necessary to make positive identification of an isolated dog burial (as described in Chapter 3), but it is probable that the Jomon dog burial record is much more abundant than even this data suggests. Another issue in Japanese archaeology, which affects the data presented in this chapter, is the ongoing debate over the use and dependability of radiocarbon dating. Many Japanese archaeologists have been reluctant in using radiocarbon dating, resulting in no systematic use of radiocarbon dates within the Jomon literature. Most traditional dating references have used Jomon pottery typologies, which were considered to be so fine-grained that they were more reliable than radiocarbon dates. These pottery typologies typically divided the Jomon period into phases and subphases, a system which continues to be used in Jomon literature. Increasingly, radiocarbon dates have begun to be used by Japanese archaeologists, though their use continues to be a highly controversial topic. This chapter employs the newest, most generally accepted version of the Jomon phases and their associated chronological dates from Harunari et al. (2003; Tab. 6.1).

Younger Dryas	ca. 12,900-11,650 cal. B.P.
Incipient	ca. 12,000-10,000 cal. B.P.
Initial	ca. 10,000-6,000 cal. B.P.
Early	ca. 6,000-5,000 cal. B.P.
Middle	ca. 5,000-4,000 cal. B.P.
Late	ca. 4,000-3,000 cal. B.P.
Final	ca. 3,000-2,400 cal. B.P.

Table 6.1. Dates of different time periods in the prehistory of Japan (after Harunari 2003)

While it is often commented that the ‘Jomon culture’ dominated the Japanese archipelago for over 10,000 years (e.g. Aikens and Higuchi 1982), it should be noted that the defining feature of the Jomon period is that the culture itself is characterized by quite different traits across the archipelago. The extreme northeast-southwest orientation of the islands, from 24-46° north latitude, means that these traits are specifically defined by the geography and climate of the various latitudinal zones, from sub-arctic in the northern most regions of Hokkaido, to sub-tropical in the southern islands (Fig. 1). This extreme variation in climatic conditions means subsistence systems practiced by Jomon-period hunter-gatherers in each area were highly varied, and included different prey species, tools, methods, and hunting adaptations. Due to these variables, different degrees of complexity can be expected among the various Jomon subcultures (Pearson 2007). Despite these differences, it is generally agreed that the Jomon people operated in an transegalitarian society, with certain individuals, such as shaman or skilled hunters (and perhaps skilled hunting dogs), earning a distinguished social role (e.g. Nakamura 1999; 2000; Watanabe 1990). This chapter focuses on the Jomon subculture which dominated the eastern side of the main island, Honshu, where the majority of the Jomon shell midden sites and population are clustered, as well as the Jomon-period isolated dog burials. It is in this part of Japan, which saw an environmental shift to temperate deciduous forests in the early Holocene, that complex foragers flourished in an ecotone that consisted of abundant nut-bearing hardwoods, an influx of sika deer and wild boar, and a static resource of shellfish and coastal fish due to sea-level rise on the low-lying eastern plains. It is the unique combination of these climatic conditions and associated resources which made this region of Japan most appealing to early Holocene foragers, and provided the ideal location for the utilization of dogs as a dense forest-hunting adaptation.

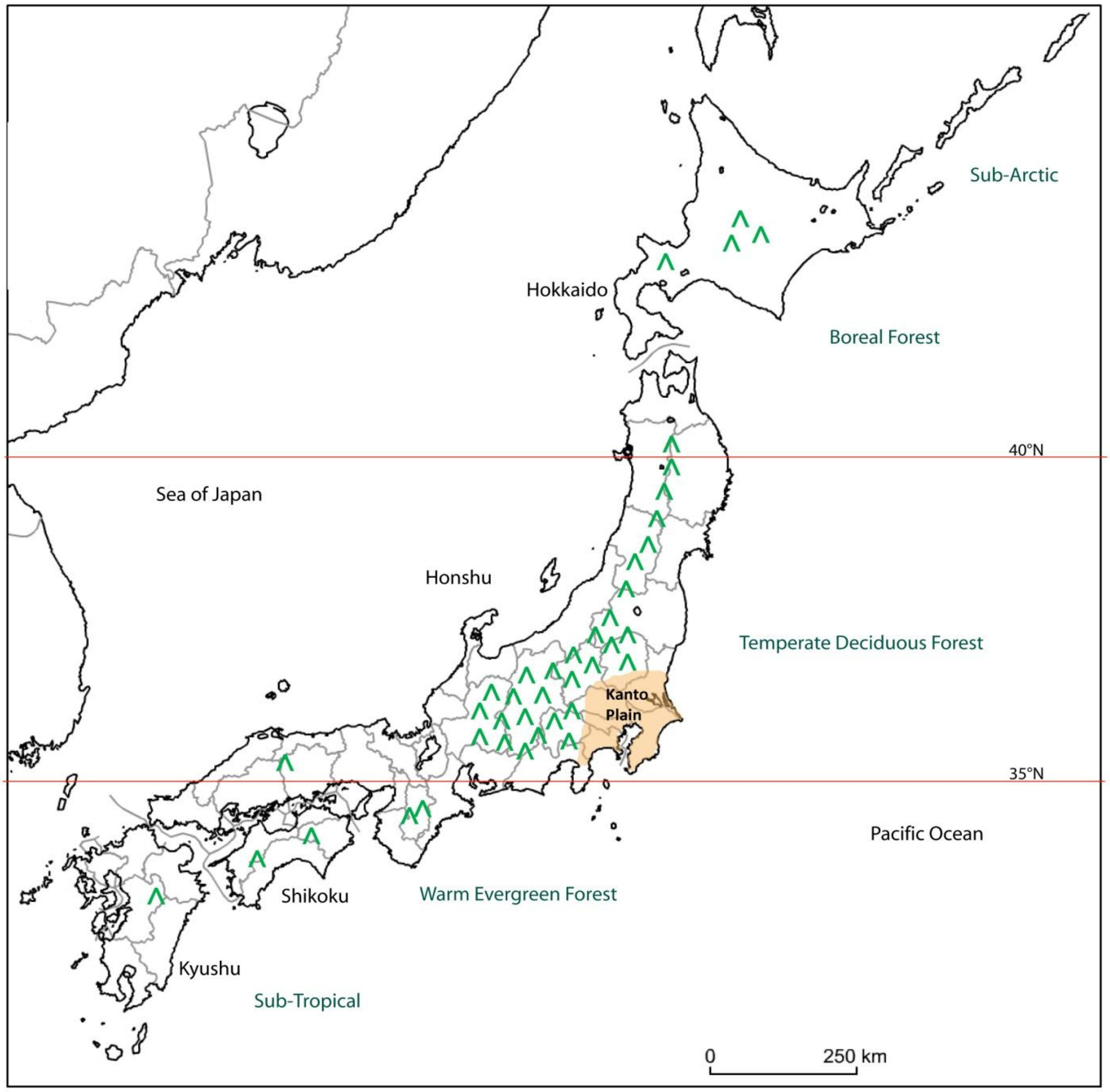


Figure 6.1. Map of the islands of Japan with associated early Holocene Jomon-period environmental biomes and mountain ranges (^)

Location

Japan is comprised of a set of islands, the largest of which is the central island of Honshu, that have a largely mountainous terrain with areas of low-lying plains, especially in northeastern Honshu (Fig. 1). The extensive northeastern-southwestern orientation of the archipelago means that from north to south the islands encompass a range of climatic and environmental niches, which are today fairly similar to the environments experienced by early Holocene foragers. Of the niches, the islands can generally be divided into five different environmental areas (Fig. 1). As noted by Kobayashi et al. (1992), the different regional units of the Jomon are commonly defined through their climatic and environmental variation. The sub-arctic northernmost island of Hokkaido tends towards a humid, continental climate with long, cold winters, low precipitation, and a taiga/boreal forest biome. In the very southwestern portion of Honshu Island, as well as in Shikoku and Kyushu the environment is dominated by warm temperate evergreen forests, warmer temperatures, and increased rainfall. In the far southern islands of Ryukyu the climate is sub-tropical with mild winters, hot summers, and high precipitation. In the central portion of the main island of Honshu the dominant environment is temperate deciduous forests, including oak, walnut, and chestnut, with a dense understory of various smaller trees, shrubs, and flowering plants. Importantly, a mountain range runs through the center of Honshu, dividing it into eastern and western halves, which creates several significant differences in the climate of the two areas. The western half of central Honshu, on the Sea of Japan side, is affected by seasonal winds which deposit heavy snowfall and leave the area generally cooler than the eastern side of the island. Additionally, due to its close proximity to the continent, the western side of Honshu usually receives less rainfall, leading to a drier environment. In contrast, the eastern side of central Honshu has a climate that sees cold winters with little snowfall and warm, humid summers due to seasonal winds, with much heavier rainfall. Additionally, in comparison to western Honshu, or any other region of Japan, the topography of eastern Japan is abundant in flat, low-lying plains, most notably the large Kanto Plain near modern-day Tokyo (Fig. 1).

The abundance of low-lying plains in eastern Japan, in combination with early Holocene sea-level rise, is thought to have led to the proliferation of numerous shell midden sites scattered across the eastern coast of central and northeastern Honshu during the Jomon period. Of the close to 30,000 Jomon sites accounted for by Oikawa and Koyama (1981), less than 3% were shell mounds. Yet, of those 3%, more than 80% of the shell middens were found along the central and northeastern coast of Honshu, especially in the Kanto and Tohoku regions (Habu, et al. 2011; Fig. 5). As seen in North America and northern Europe, these shell mounds began forming during the early Holocene during the initial period of sea-level rise, and increased in size and number over time, with continuing sea-level rise through the Late Jomon period. Also comparable to other regions discussed in this thesis, the isolated dog burials from the Jomon period almost exclusively correspond to these areas of shell middens in central and northeastern Honshu, with 37 of the 39 dog burial sites being shell mounds. Uchiyama (2006) has speculated that the majority of large Jomon settlements were located in eastern Honshu due to the very specific ecotone created by the geography and topography, producing an overlapping junction of different productive environments, such as broadleaf forest and estuary. Similarly to the Mid-South of North America and northern Europe, it is this highly productive ecotone which drew Jomon foragers to eastern Honshu in order to utilize the abundant static coastal resources, as well as the nut and meat resources accessed from the nearby deciduous forests. These static resources created sedentary populations which needed to maximize their subsistence take in the face of growing populations, leading to dogs becoming an important hunting tool for minimizing hunting risk in eastern Honshu.

Palaeoenvironmental Reconstruction

As previously discussed, due to the extent of latitudinal distance covered by the north-south orientation of the Japanese islands, a range of climates and environments are encountered. For prehistoric foragers this translates into significantly different environmental niches to exploit, including important differences in nut availability, coastal resources, and hunted prey species. Unfortunately, as with much of the prehistoric record, a great deal of the Japanese vegetation history has not been available to the international community, thus the implications of the Jomon environments as part of a global context has been limited (Takahara, et al. 2000). During the late Pleistocene the Japanese islands were still connected to the mainland, and the majority of the archipelago was covered with boreal conifer forests, with some arctic taiga in northern Hokkaido and limited regions of glaciation at the highest summits (Aikens and Akazawa 1996). With the warming of the early Holocene period, temperate deciduous forests, which had been in refuge in the southern islands, began pushing their way north into Honshu, bringing with them their associated fauna. Researchers suggest that the new Jomon adaptation began with this climatic warming and the spread of deciduous forests, which were crucial to the prosperous Jomon populations in eastern Honshu (Koike 1986; Pearson 2007). Beginning in the Incipient Jomon phase, nuts were clearly being stored at sites, sometimes in very large quantities, with oak acorns, beechnut, walnut, and chestnuts frequently being recovered from sites across Honshu (Kobayashi, et al. 2004).

With this warming Japan also became an island country, with rising sea levels cutting it off from the mainland. During the Late Pleistocene, around 11,600 cal B.P., sea levels in Japan were 20-30m lower than present (Iseki 1977). With the changing climate sea levels slowly began rising, eventually surpassing current levels. The maximum marine transgression, referred to as the Holocene or Jomon Transgression, happened between 7,400-5,900 cal B.P. (Matsushima 1979), with Koike (1986) pinpointing it to around 6,500 cal B.P. Koike (1986) stated that the transgression flooded the coastline and raised sea levels to between 3.5-5.5m above present, while Ota et al. (1982) suggest early Holocene sea levels climaxed at up to 6m above present levels. These rising sea levels created deeply cut bays, inlets, and tidal flats along the Japanese coastline, especially across the low-lying plains of eastern Honshu, maximizing the coastal length and significantly increasing biotic productivity (Aikens and Akazawa 1996). Akazawa (1986) has noted that the shell midden sites of eastern Honshu were almost always located in a transitional zone between two productive environments, which suggests Jomon settlement systems were determined in a way that took advantage of maximizing numerous resources. Due to the variation in climates and environments, Jomon foragers in different areas practiced different regional procurements systems, with marine mammals dominating the diet of the northern island of Hokkaido, marine fish being most important in the southern islands, and a combination of nuts, shellfish/coastal fish, and terrestrial animals being important in Honshu, with a particularly heavy reliance on nut resources on the colder western side of the island. The transition to Holocene conditions generally enhanced the overall biotic productivity of the archipelago, increasing the variety of edible plant foods and strengthening the habitat of forest ungulates, like sika deer and wild boar, which became the most commonly hunted animals in eastern Honshu (Aikens and Akazawa 1996; Habu 2004; Harunari 1998; 2000).

Burials

Throughout the literature on Jomon archaeology, it is commonly mentioned that hunting dogs were considered to have been kept by Jomon foragers since the earliest period, though little evidence has been provided to support this theory (e.g. Nishinakagawa, et al. 1994). Kobayashi (2004) postulated that Jomon dogs were likely domesticated as hunting assistants, Imamura (1996a) cited hunting with bows and dogs as one of the basic economic features of the Jomon period, and several other researchers (Funk 2008) have consistently noted their elaborate burial from Jomon-period sites (Fig. 11). They have also suggested that these burials appear to be a cultural phenomenon linked specifically to the Jomon foragers of eastern Japan, as they are not seen in any other part of the archipelago during the Jomon period, and conspicuously ends with the influx of the subsequent Yayoi culture and agricultural subsistence (Funk 2008; Kobayashi, et al. 2004), a circumstance Funk (2008) attributes to their loss of importance as hunting companions. The suggestion that dogs may have been particularly important to the Jomon in this area is supported by the finding of dog-shaped clay figurines from the Korekawa site in the Tohoku region (Fig. 2) and the Fujioka Jinja site in the Kanto region (which was found in association with three boar-shaped figurines; Fig. 3), and a ritual bronze bell decorated with the image of a human and dog pack hunting a wild boar (Fig. 4).

Figure 6.2. A clay dog figurine from the Final Jomon site of Korekawa in the Tohoku region (photograph: Korekawa Jomon Center)

Figure 6.3. A clay dog figurine from the Final Jomon site of Fujioka Jinja in the Kanto region (photograph: Fujinuma 1997)

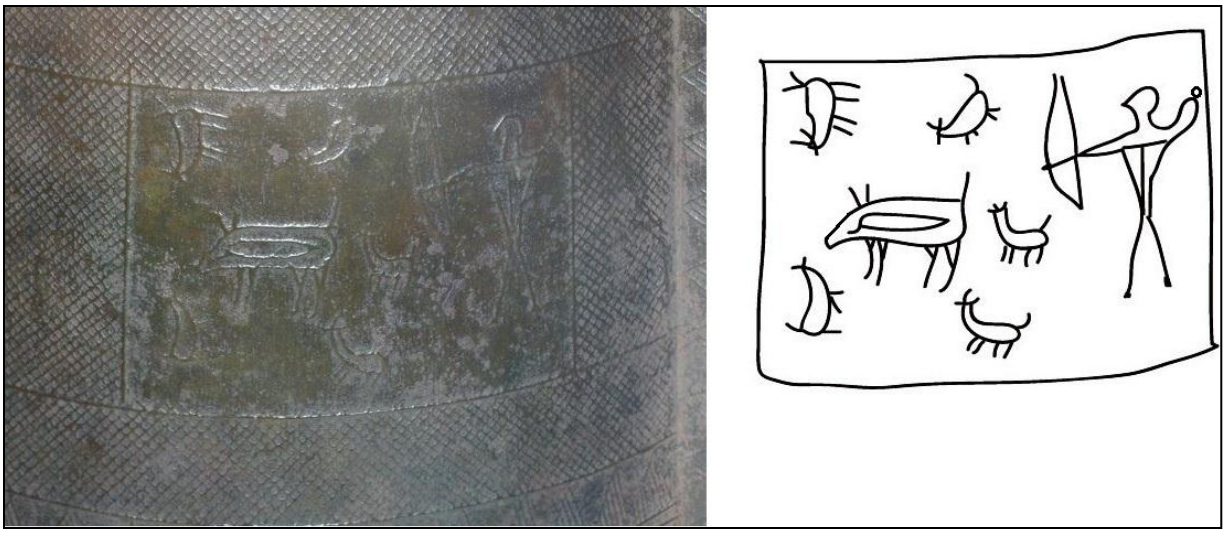
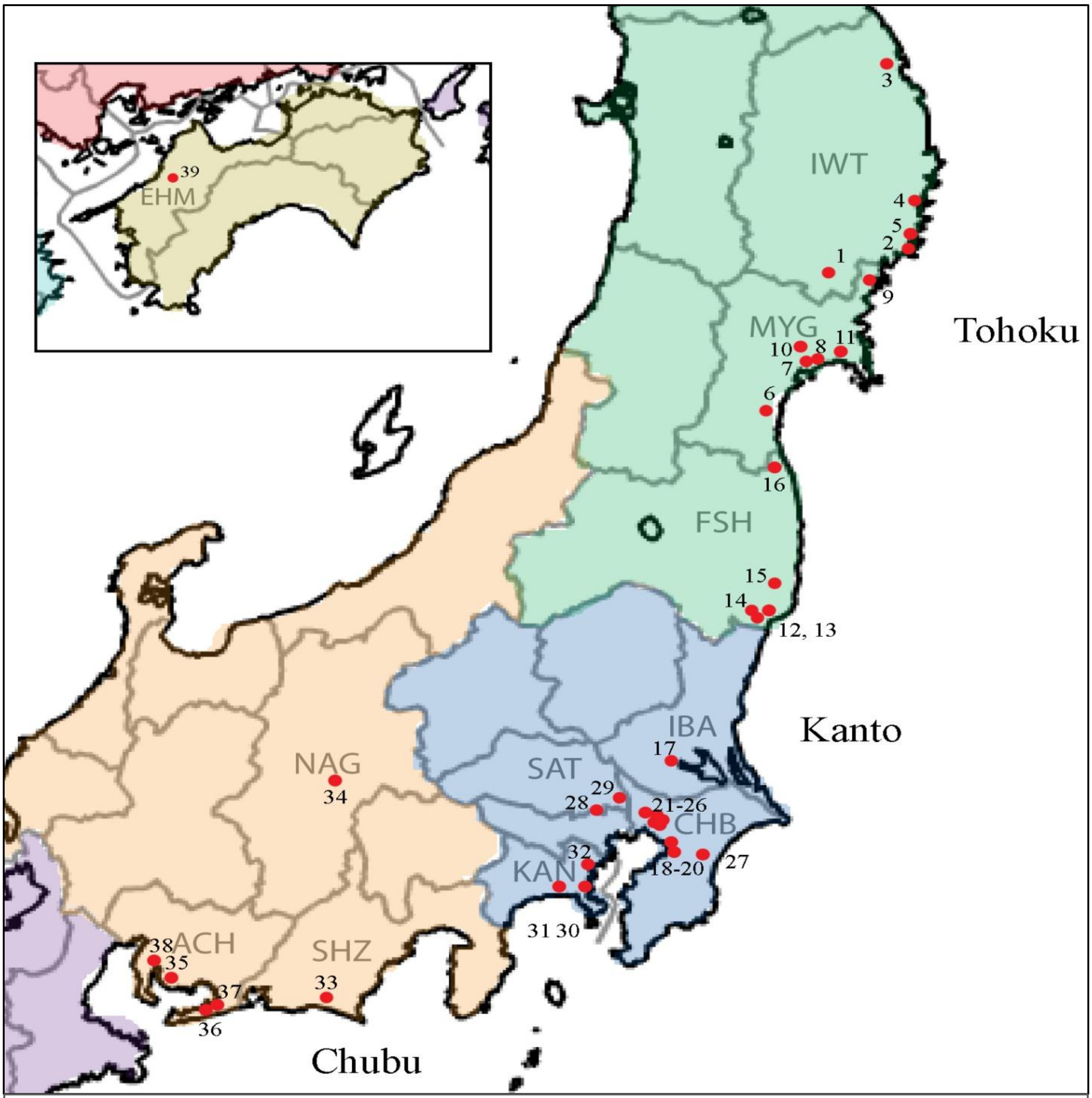


Figure 6.4. A ceremonial bronze bell (*dotaku*) depicting a hunter and hunting dogs surrounding a wild boar

This chapter presents 39 Jomon-period archaeological sites with identified isolated burials (Fig. 5). Due to the acidic nature of the Japanese soils, which poorly preserve skeletal material, there is a high probability that the number of isolated dog burials deposited was actually much larger than what the archaeological record has demonstrated. Of the archaeological sites presented here, one third have archaeological reports which do not list the exact number of dog burials excavated. Some only note that the burials were encountered, while others give ambiguous counts, such as "some". Of the 26 sites which have exact recorded numbers for isolated dog burials found, there a total of 109 individuals. These burials begin in small numbers in the Initial Jomon phase (after 10,000 years ago) and increase in number of burials and sites through the Late Jomon phase, with the largest number of burials occurring from the Middle Jomon and later (Fig. 6). Many of the chronological units assigned to individual burials span several phases, due to the burial's occurrence at a multi-phase site, for which specific dates for the dog burial itself have not been identified (Table 6.2). There are two sites dating from the Initial phase, with one burial each. From the Early phase there are three sites, two of which have one burial each, with the last having an undisclosed number of burials. In the Middle phase there are eight sites with over 34 isolated burials between them. Three of these sites have no information provided on the actual number of burials excavated. In the Late phase there are seven sites (one of which has no information on the number of burials), with over 15 burials. The Final phase has six sites (two of which do not include burial numbers), with over 35 burials. Of the isolated burials which are part of multi-phase sites, there are three individuals from a site dated from the Early to Final phases, three sites dated from the Middle to Late phases with over two burials (two of the sites do not have recorded burial numbers), one site from the Middle to Final phases which does not have a recorded number of burials, and seven sites dated from the Late to Final phases with over 16 burials (two of the sites have no recorded burial numbers). There is also one site from the record which is only generically dated to the Jomon period and does not include the recorded number of burials.



1: Kaisori
2: Nakazawahama
3: Monzen
4: Oohora
5: Shimofunato
6: Ugasaki
7: Kawakuda Rihibiki
8: Satohama
9: Tagara
10: Nakasawame
11: Minamizaki
12: Terawaki
13: Ohata
14: Kaminouchi
15: Usuiso
16: Sanganji
17: Koyamadai
18: Kasori North
19: Kasori South
20: Yahagi
21: Fujiwara Kannondo
22: Kamishinjuku
23: Ebigasaku
24: Kainohana
25: Takanekido
26: Soya
27: Shimoota
28: Ishigami
29: Hanazumi
30: Natsushima
31: Tsutsumi
32: Nishinoyato
33: Nishikaizuka
34: Wanaba
35: Karekinomiya
36: Ikawazu
37: Yoshigo
38: Motokariya
39: Kamikuriowa

Figure 6.5. Map of the isolated dog burials of Jomon-period Japan, by region (color-coded) and prefecture (Ehime-EHM, Iwate-IWT, Miyagi-MYG, Fukushima-FSH, Ibaraki-IBA, Satohama-SAT, Chiba-CHB, Nagano-NAG, Kanagawa-KAN, Shizuoka-SHZ, Aichi-ACH)

Phase	# of sites	# of burials	# sites w/o info
Initial	2	2	0
Early	3	2+	1
Early to Final	1	3	0
Middle	8	34+	3
Middle to Late	3	2+	2
Middle to Final	1	+	1
Late	7	15+	1
Late to Final	7	16+	2
Final	6	35+	2
Jomon	1	+	1

TOTAL	**39**	**109+**	**13**

Table 6.2. Jomon-period isolated dog burials by chronological phase, sites with additional unreported numbers of isolated dog burials are indicated (+)

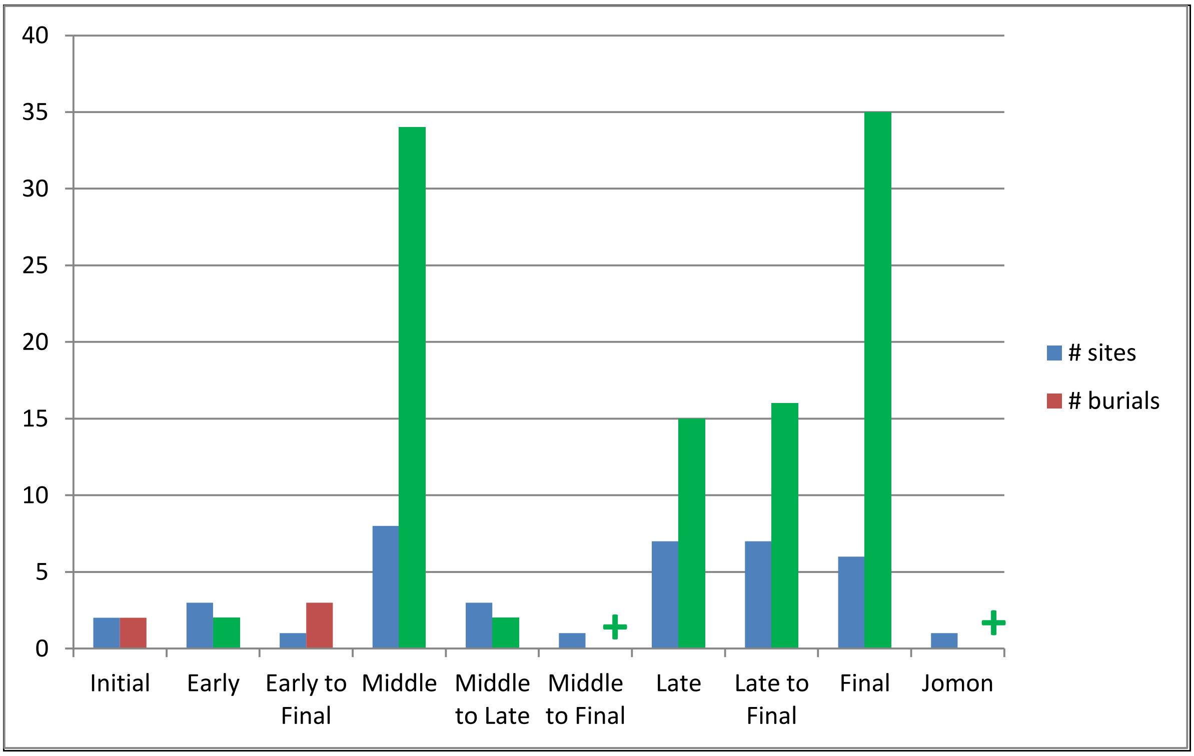


Figure 6.6. Number of archaeological sites with isolated dog burials by chronological phase, including sites with additional unreported numbers of burials (green, +)

Like the isolated dog burials from the Mid-South of the United States, the burials in eastern Japan begin in small numbers, with just two from the Initial Jomon phase. One of these sites, Kamikuroiwa, is one of only two sites from the entire record that is not a shell midden, but a rockshelter. Interestingly, Kamikuroiwa is also the only site with a isolated dog burial that is not located on Honshu, but is instead located on Shikoku, further south (Fig. 5). This suggests that the practice of isolated dog burials may have started in small numbers in the deciduous temperate forests of early postglacial southern Japan, then moved northward into Honshu with the continued warming and spread of deciduous forests, eventually becoming a regular practice of the sedentary temperate forest foragers of eastern Honshu. This close association, between the spread of temperate forests and the practice of isolated dog burials, suggests that dogs were an important part of temperate forest hunting adaptations. This theory is supported by the fact that isolated burials are not found in the southern islands where the Holocene climate change introduced sub-tropical and warm evergreen forest, nor are they found in the far north beyond the extent of the deciduous forests. As seen from the other two regions examined in this thesis, many of the Jomon dog remains exhibit severe injuries, mostly to the limbs, which have healed (Fig. 7), suggesting (a) as documented in the Archaic dogs of North America, these dogs likely had close, constant contact with the large prey animals (sika deer and boar) of the deciduous temperate forests, and (b) the dogs must have been well cared for as many of the injuries were so serious that recovering from them would have been difficult or impossible with the help of human care.

Figure 6.7. Fractured and healed right tibia from an isolated dog burial at the Late-Final Jomon site of Usuiso in Fukushima prefecture (Otake 1983)

Discussion

It has been suggested that though the period starting from 15,500 cal B.P. is cited as the 'Jomon', what is culturally considered Jomon begins with the start of the Holocene period (Kudo 2004; Taniguchi 2002; Watanabe 2007). These groups have long been identified as highly-successful transegalitarian societies, with lifetime accomplishments or age-based rites of passage acting as identity determinants (Amakasu 1986; Imamura 1996b; 2006; Kobayashi, et al. 1992; Okamoto 1975; 1986; Watanabe 1986). Analysis of tooth ablation from Jomon cemeteries suggests that such physical indicators of identity were based on accomplishments of an individual, suggesting achievements in life were reflected in death (Funahashi 2003; Temple, et al. 2011). This not only supports the transegalitarian nature of the Jomon people, but suggests that hunting dogs, which served an economically important function in life, and perhaps in turn earned an enhanced social status, were buried as accomplished individuals as well. Though Jomon-period shell middens date from the early Initial Jomon period, the year-round sedentary settlement system that is at the core of the Jomon identity is firmly established at around 7,000 cal B.P. Though there are two isolated dog burials not found at shell midden sites, the majority of the dog burial record is strongly associated with groups which inhabited the shell middens of eastern Honshu. In reference to Renfrew's (1976) discussion of territorial expansion of small-scale societies, and Chapman's (1995) argument for cemeteries as territory and resource claims, Temple et al. (2011) have suggested the large shell midden sites in eastern Honshu, such as the Yoshigo site which includes over 350 human burials and 12 dog burials, may have acted as territorial displays by local Jomon groups reacting to increasing sedentism, populations, and resource pressures as early Holocene warming intensified.

A common problem within Jomon archaeological research is a tendency to group the people from all the islands into a single cultural unit. This is no more evident than in the analysis of Jomon subsistence strategies, which has misleadingly been summarized by Kobayashi's popular "Jomon calendar" (Fig. 8). The acceptance of this model for the entirety of the Jomon population falsely assumes a large variety of subsistence resources were equally available across the islands, and makes no allowance for regional and temporal differences. In contrast to this generalized picture of the Jomon diet, Habu (2004) has noted that the different Jomon subcultures actually tend to align much more with Binford's (1980) theory of collectors, specialists who rely on a few key resources. Several researchers have stressed the variation in Jomon subsistence systems across different regions (e.g. Tozawa 1989), with Akazawa (1986) proposing that specific ecotones characterized different Jomon regions. Of these ecotones, Akazawa stated that the shell midden sites of central and eastern Honshu were characterized by a temperate forest-estuary ecosystem, supported by finds of stone sinkers and projectile points for terrestrial mammal hunting. Different ecotones and tool kits characterized other parts of the islands, such as harpoons for sea mammal hunting in the north, and stone querns for extensive nut grinding in western Honshu.

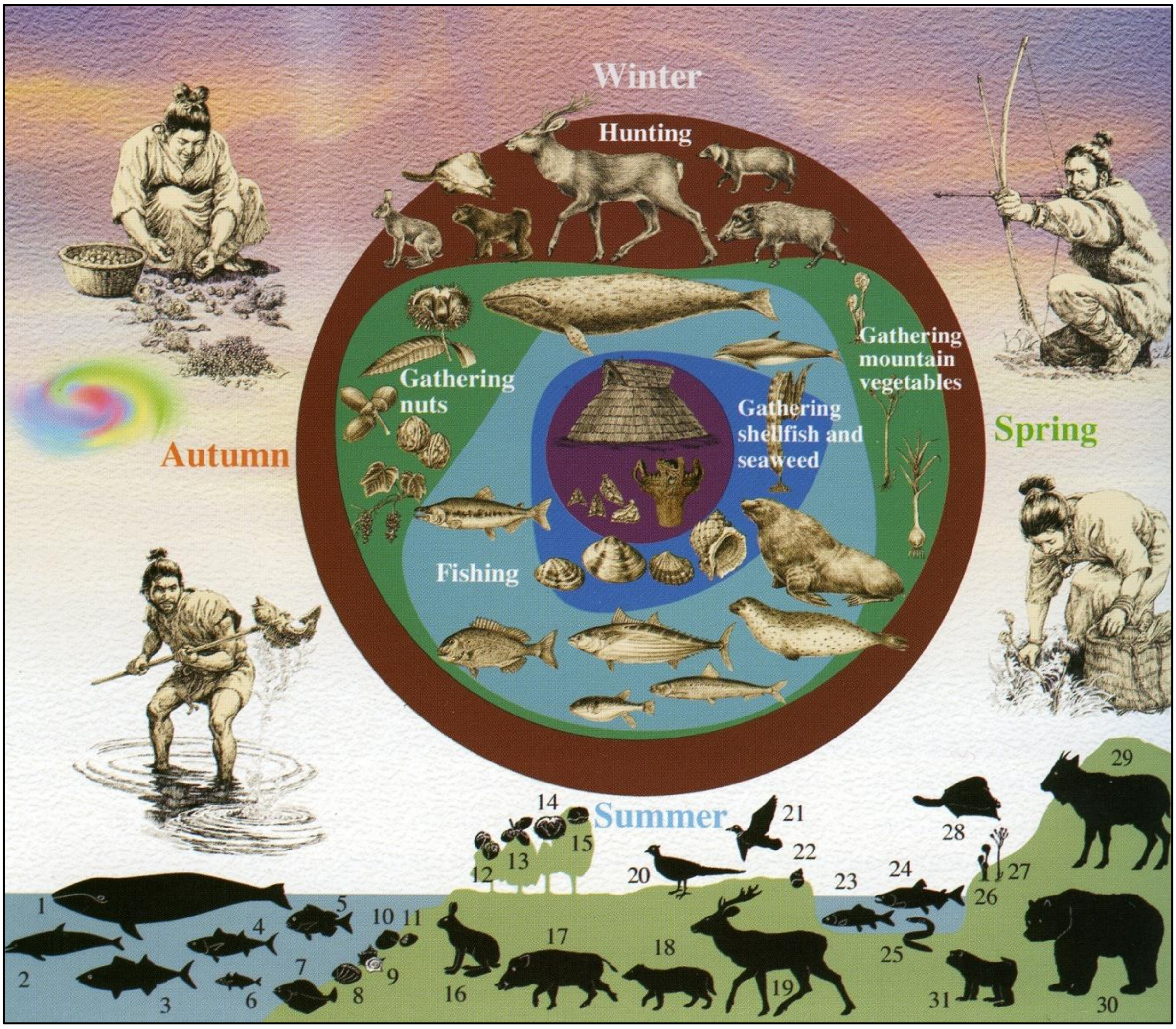


Figure 6.8. The 'Jomon Calendar', a traditional view of year-round Jomon subsistence practices (Kobayashi, et al. 2004)

The shift to hunting medium-sized terrestrial mammals, like sika deer and wild boar, in eastern Honshu, with increasingly adapted technology followed the warming of the early Holocene and northern movement of the temperate deciduous forests. These postglacial changes in flora and fauna triggered a reorganization of subsistence strategies, requiring adaptations away from hunting the large terrestrial fauna of the late Pleistocene, towards a more focused strategy to take quick, solitary prey in a dense forested environment (Inada 1986; Okamoto 1986; Tsuji 1997). These changes are well documented in the technological advances seen from the period. Inada (Inada 1986; 2001) noted changes in lithic tools from large Pleistocene bifacial projectile points, to small arrowheads in the early Holocene, suggesting use of the bow and arrow. Similar changes to a complex of small, triangular points were also noted by Aikens and Higuchi (1982). Aikens and Akazawa (1996) have argued that this change in blade technology began in the southern islands and worked its way north with the changing biota. They suggested that there were strong connections between Jomon-period environmental and cultural changes, and these connections could be linked through the appearance of Holocene biota, Jomon subsistence, and sedentism.

The high dependence on deer and boar practiced by the Jomon of eastern Honshu has long been established by researchers, through analysis of faunal material (e.g. Akazawa 1986; Koike 1986). Of the Jomon shell middens which have produced animal bones, over 98% have deer and boar as the most common remains (Koyama 1979). Anezaki (2007) noted that at Jomon sites in the southern Kanto region sika deer made up between 13-65% of the total subsistence remains, and wild boar between 31-57%. Oikawa and Koyama (1981) observed that the Jomon record in southern Japan is not as strong as it is in Honshu, leading them to suggest that the Jomon way of life flourished more in the temperate deciduous woodland, as opposed to the warm evergreen forests. They suggested the close juxtaposition between the static shellfish resources and terrestrial forest game allowed for sedentary populations. In an analysis of the Karekinomya shell midden site, from which there is one isolated dog burial (Fig. 10), Watanabe (2007) found a majority of terrestrial game, which would have been taken from forests estimated to be within about a 50 minute walk from the site. Interestingly, when the local forests shifted to a more boreal character, during a cooling period in the Final Jomon phase, the Karekinomya site was abandoned, which Watanabe attributed to decreased hunting returns due to ungulate abandonment of the pine forest. The preferred habitat of sika deer and boar is the temperate deciduous forest, with both animals feeding on the various nut resources, and utilizing the dense understory as a means of cover from predators. It is likely that the lower proportion of deer and boar remains observed from sites in western Honshu is due to the fact that the animals migrate away from the area seasonally, to avoid the deep snows (Koyama 1979). Additionally, in Japan the sika deer are highly dependent on bamboo grass, which grows on the temperate forest floor and cannot flourish in areas of high snowfall, like western Honshu (Koike 1992). Soil analysis from the Kanto region shows that bamboo grass covered the deciduous forest floor there during the Jomon period, thus making the area ideal for hunting sika deer (Koike 1986). Koyama (1979) has noted that the incidence of dog burials in eastern Honshu correlates well with the high numbers of deer and boar hunted in the area.

A variation in diet within the Jomon subcultures is strongly supported by isotopic analysis and archaeological evidence, which shows that the subsistence systems practiced by Jomon people across the islands differed greatly (Fig. 9). Sites in Hokkaido and very northern areas of Tohoku are characterized by anchors, fishhooks, and toggle harpoon heads. Isotopic signatures from human remains support the suggestion that they were largely dependent on marine mammals and fish (Akazawa 1986; Minagawa 2001; Minagawa and Akazawa 1992). Jomon in the southern areas, like Kyushu and Ryukyu, have isotopic signatures which suggest they were consuming large amounts of marine foods (Minagawa 2001), while sites in southwestern and western Honshu yield stone querns, grinding slabs, stone sinkers, and human isotopic signatures similar to terrestrial herbivores, suggesting a heavy reliance on plant and nut resources (Minagawa and Akazawa 1992). At Awazu, a rare shell midden site from western Honshu, subsistence analysis suggested that nuts represented over 52% of the diet, with fish and shellfish comprising another 36%. Terrestrial mammals accounted for less than 11% of the total remains (Habu, et al. 2011). Kusaka et al. (2010) have suggested that the greatest regional variation is seen on Honshu, where a mountainous central ridge divides colder western Honshu from the warmer, low-lying eastern Honshu. Despite the prevalence of Jomon shell middens from eastern Honshu, it is thought that shellfish actually contributed fairly little to the caloric intake of these groups (Habu 2004). Supporting the finding of significant deer and boar remains, the isotopic analysis of Jomon people from the shell middens of eastern Honshu suggests they had a diet that was highly dependent on terrestrial game (Habu 2004; Kusaka, et al. 2010; Minagawa 2001; Minagawa and Akazawa 1992), and to a lesser extent marine fish and nuts. Isotopic evidence from both Yoshigo (a site that had twelve isolated dog burials) and Sanganji (a site that had three isolated dog burials) shows the inhabitants had diets with a large portion of the protein coming from terrestrial game (Akazawa 1986; Kusaka, et al. 2008). A reliance on terrestrial game is further supported by high quantities of stone projectile points found from the sites in eastern Honshu (Akazawa 1986).

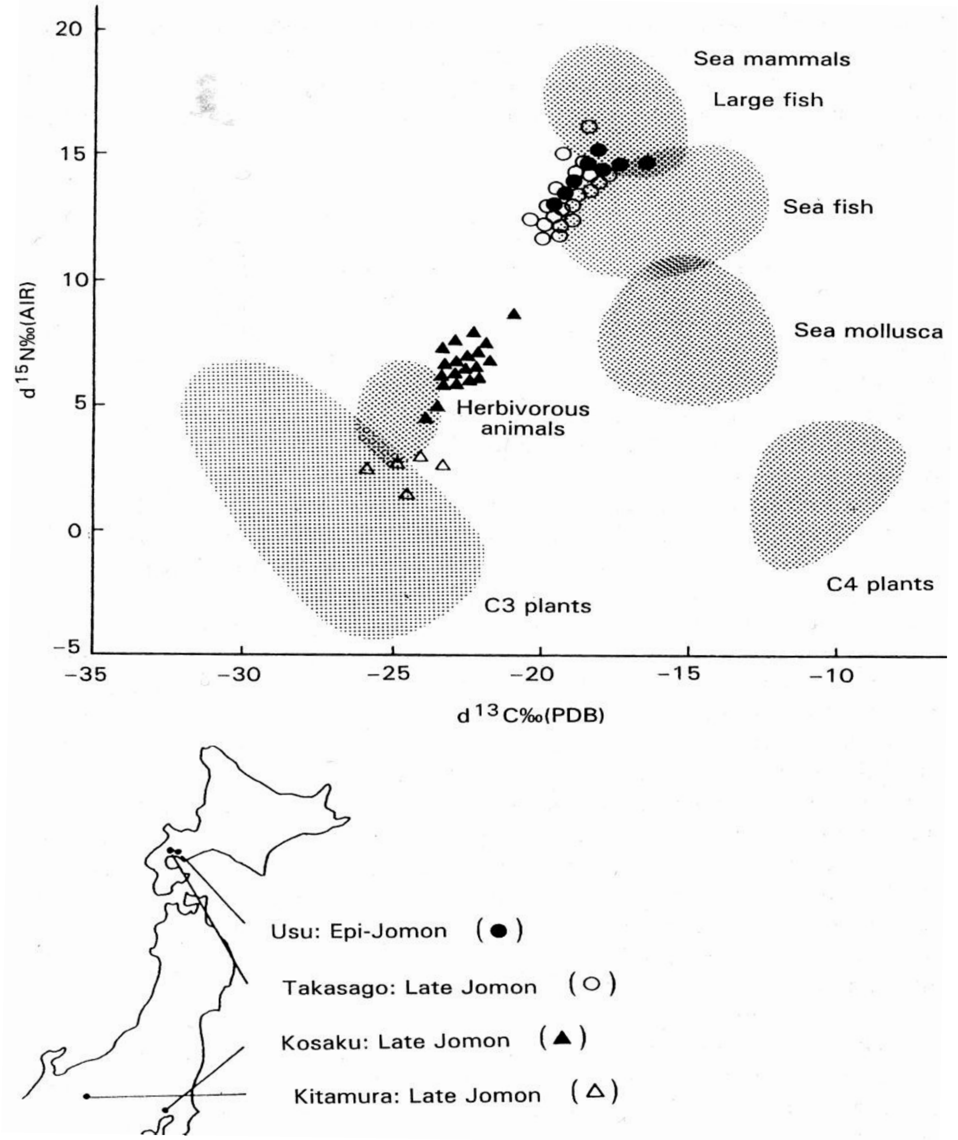


Figure 6.9. Analyzed carbon and nitrogen isotopes from Hokkaido, western Honshu, and eastern Honshu, displaying dietary differences between Jomon from different regions (Minagawa and Akazawa 1992)

While it is clear that terrestrial game hunting was an important part of the subsistence economy of the eastern Honshu Jomon, the hunting methodology and adaptations to changing biota appear to have varied over time. As seen in North America and northern Europe, during the Incipient Jomon phase populations were still highly mobile, and there are very few dwellings reported. During this early period the use of pit-traps was common, but after the Pleistocene-Holocene transition the use of pit-traps decreased in favor of new hunting techniques which utilized the bow and arrow, and most likely dogs, as hunting aids in the new dense deciduous forests (Cohen 1981; Imamura 1996b; Sato 1995a). In this Initial Jomon phase there was also the first appearance of shell middens, specifically in eastern Honshu. The Kanto and Tohoku regions of Honshu are particularly well known for their large shell middens sites, with over 60% of the known Jomon middens occurring on the Kanto Plain. In earlier phases the shell middens tend to be fairly small, while those in the later phases are much larger, such as Kasori North (130m, two dog burials) and Kasori South (170m, three dog burials; Tozawa 1989).

Figure 6.10. An isolated dog burial with prepared pit from the Final Jomon Karekinomiya site in Aichi prefecture (Sumiyoshi 1981)

The increasing size of shell middens over time, as well as adaptations in hunting methods, suggests rising Jomon populations may have put growing pressure on terrestrial subsistence resources. Cohen (1981) has suggested that the shift from pit-trap hunting to hunting with projectiles was triggered by increasing pressure on terrestrial game resources in the Early Jomon phase. It has been documented that the age composition of sika deer changes at eastern Honshu Jomon sites over time, with Early Jomon sites having a high percentage of older deer, but Late and Final Jomon sites, like Yahagi (a site with two dog burials), having a very high proportion of young deer, suggesting population and hunting pressure were prevalent in the area (Koike 1986; Koike and Ohtaishi 1985). Koike (1992) also argued that population pressure could be seen in the collection of younger and younger shellfish at midden sites, and Imamura (1996b) suggested the same for the increased use of plant foods over time, beginning specifically in the Middle Jomon. Cohen (1981) has suggested that this increasing subsistence complexity and use of a variety of resources comes not from any type of technological innovation, but as a response to resource crowding and population pressure.

Many researchers have noted that eastern Honshu populations reached their height in the Middle Jomon, but that site numbers began to decrease in the Late and Final Jomon as population pressure pushed against the limitations of the environment, which would have increased hunting risk, and the value of a good hunting dog (Amakasu 1986; Habu 2004; Koyama 1984; Oikawa and Koyama 1981; Okamoto 1975; 1986). Not surprisingly, it is during these later phases of the Jomon period when the largest number of isolated dog burials is seen. While there is not much discussion in the western language literature about interpersonal violence among the Jomon, Kobayashi (2004) did cite the finding of stone arrowheads embedded in human bone from the Final Jomon Ikawazu shell midden (a site with seven dog burials), suggesting increasing resource pressure may have lead to conflicts.

Figure 6.11. An isolated dog burial from the Early Jomon site of Ugasaki in Miyagi prefecture (Oikawa 1980)

Conclusion

During the late Pleistocene the islands of Japan, which were still connected to the mainland at that time, were primarily covered in boreal conifer forests and arctic taiga. The hunter-gatherers who inhabited the area subsisted on a diet of small game, birds and aquatic species, and used large, bifacial points to take the occasional megafauna, such as Naumann's elephant or Yabe's giant deer. With the warming climate that started during the Pleistocene-Holocene transition, deciduous temperate forests which had been in refuge in the far southern islands began to push their way north into the main island of Honshu. This transition saw the disappearance of megafauna and the ushering in of the temperate broadleaf fauna, primarily sika deer and wild boar, into the temperate region of Honshu. With this transition also came adaptations and changes for the hunter-gatherers who inhabited the region. No longer hunting large herd animals on open taiga or boreal forests, the Jomon foragers of the time adapted their hunting techniques to effectively take the quicker, more solitary medium-sized ungulates that populated the new dense deciduous forests. These adaptations took the form of new settlement patterns, subsistence models, tool technology, and perhaps most importantly the utilization of the dog as a critical hunting aid.

While 'Jomon' is the common cultural label given to all early Holocene inhabitants of the Japanese islands, groups from different parts of the islands subsisted in very different ways. The Jomon in the north, including Hokkaido, were highly dependent on marine mammals and deep sea fishing, while in the far southern islands marine fish were the primary diet. While temperate deciduous forests covered the main island of Honshu, the central mountain range and contrasting weather systems created very different lifestyles in the east and west. Seasonal winds, heavy snowfall, and steep coastlines left foragers in western Honshu with poor access to shellfish, lower populations of seasonally-migrating ungulates, and a high dependence on deciduous nuts. In contrast, the Jomon of eastern Honshu utilized abundant shellfish resources due to early Holocene sea-level rise on the low-lying plains, a generally warmer climate with low snowfall, and high populations of temperate forest ungulates, making this one of the most productive areas of Jomon Japan. It is in this area that nearly every isolated dog burial of the Jomon period is found, likely a consequence of the dog's indispensable utilization as a dense forest hunting tool and increasing importance in minimizing hunting risk as populations and hunting pressure grew. This increasing importance is reflected in the escalating numbers of dog burials found from the Middle Jomon period on, correlating with the period of rising populations and subsistence stress. Subsequently, as is seen in every geographic location discussed in this thesis, the value of hunting dogs fades, as do their burials, with the influx of the succeeding Yayoi culture and the introduction of agricultural subsistence.

Chapter 7: Dogs in Hunting Groups: Past and Present

Introduction

The role of hunting dogs, in the past and present, has always been a topic of great interest in hunter-gatherer studies. An understanding of the relationship between dogs and modern hunter-gatherer groups can be useful in our perception of the relationship between dogs and hunting peoples in the past. The natural hunting prowess of the dog's genetic ancestor, the grey wolf (*Canis lupus*), suggests an innate hunting capability and proficiency in the domestic dog as well. While many ethnographies of modern hunter-gatherer groups include a wealth of information on the use and importance of hunting dogs, the integration of this information and its application to the archaeological record has been lacking. Jones (1970: 270) and Kelly (1995) suggested more work needed to be done to develop "a cross-cultural analysis of the relationship between man and dog in various hunter-gatherer societies". Lupo (2011b) has stated that the impact of different dog deployment strategies and their effect on human behavior and the zooarchaeological record are still underexplored. Although some researchers argue that the dog's involvement in hunting methods cannot be documented literally in the archaeological record (Morey 2010), the study of the role of dogs in modern hunting groups can provide valuable insight into the ways in which dogs may have been utilized in hunting strategies by foragers in the past.

A hunting partnership between dogs and humans has long been postulated in the archaeological literature. Clutton-Brock (1995; 1999) suggested that dog domestication was the result of a relationship between wolves and humans formed due to similar social structures and targeted prey, leading to a natural alliance and collaborative hunting team. Hayden's (1975) assertion that the Australian dingo's use as a hunting aid was the primary reason for their adoption by Aborigines may be a clue to this close early relationship between dogs and humans. Certainly we know that dogs have evolved specialized skills for reading human communication and social behaviors, specifically the ability to take human social cues (pointing, vocal commands) without the need for direct eye contact, a critical skill when hunting with dogs (Call, et al. 2003; Hare and Tomasello 2005). While it is assumed these skills would have been apparent to prehistoric foragers, finding direct physical evidence for the use of hunting dogs may be a nearly impossible task, though it has long been noted that there is a close association in the archaeological record between hunter-gatherer peoples and dog remains which may be related to hunting (e.g. Haag 1948). Kennedy (1980) noted microliths, bows, and hunting dogs as the critical components for hunting large game in the Mesolithic and dogs are often listed as weaponry, technology, or hunting aids in modern forager ethnographies. As Hayden (1975: 12) stated, “If one decides to hunt with a dog the strategy adopted will be suited to hunting with the dog.”

This chapter examines the natural hunting ability of both the wolf and domesticated dog, the current role of hunting dogs in many modern subsistence and sport hunting groups, and hypothesizes on their probable use by hunter-gatherer groups in the past. While dogs were likely used as hunting aids by many prehistoric groups, the specific focus here is on the early Holocene hunter-gatherers inhabiting the newly-spread temperate deciduous forests of North America, northern Europe and Japan. The examination of the dog’s innate ability to sniff out, chase-hunt, and hold down prey of all types, specifically the medium-large ungulates which also make up the primary diet of their wolf ancestors, their role in substantially increasing the hunting intake of many modern hunting groups, and their often close, family-like relationship with their human hunting partners combine to make a strong, analogous case for their use and importance to foraging people in the new temperate deciduous forests of the early postglacial world.

Hunting in Wolves

Knowing that grey wolves are the genetic ancestors of domestic dogs allows for a unique insight into the potential hunting abilities of both modern and prehistoric dogs through observation of their hunting patterns. This observation offers some understanding of the role cooperative group hunting may have played in the early relationship between wolves and humans, and eventually the hunting partnership between dogs and humans. Scott (1968) suggested that the intrinsic parallels between the hunting styles of wolves and humans left them preadapted to hunting together and some researchers suggest this hunting symbiosis between the two species, social carnivores who hunt by daylight, may have given rise to dog domestication (Clutton-Brock 1984; Downs 1960; Morey 2010), with the hierarchical structure of the wolf pack allowing for the acceptance of a human as the dominant member of the group (Clutton-Brock 1984). Like many human foragers wolves are cooperative social hunters who work together to target prey animals larger than themselves. Incidentally, a wolf pack of about ten and a band of prehistoric human hunters would have had roughly the same estimated home range of about 500-1000 square miles (Fox 1978), a similarity which would have afforded a smooth transition into a hunting partnership. Wolves and humans in the past also often shared the same hunting environment and prey species and varied their movements seasonally in order to match prey abundance, being highly-mobile during one season and more sedentary in another (Fox 1978).

Like many prehistoric and modern forager groups, wolves are primarily predators of medium-large mammals, specifically ungulates (Gazzola, et al. 2005). Their prey choice usually rests on what can be most easily caught with a wider variety of prey being taken in the lean summer months (Pimlott 1975). Wolves are well known for testing their prey, picking out the slow or weak as targets, and maximizing their environments to give them the largest hunting advantage (Sullivan 1978). Deep winter snow, which wolves can travel over, but heavier ungulates sink into, is of particular use to their hunting strategy of overtaking prey (Fig. 7.1). Although mostly solitary in the spring and summer, red deer (*Cervus elaphus*) have been observed grouping together in the autumn and winter as snow increases giving wolves a better chance to pick out the weakest member (Mattioli, et al. 2004). Wild boar (*Sus scrofa*), which are particularly susceptible in deep snow, have become an increasingly important resource to wolves in the winter months due to their vulnerability (Andersone and Ozoliņš 2004). In addition to being mindful of prey behaviors and environments wolves are also known for conserving their energy and minimizing risk by giving up a chase if they are not successful after about two miles (Mech 1970). As well as considering environmental factors it is clear that the age and ecology of different prey species plays a role in the hunting decisions made by wolves. When faced with multiple ungulate prey possibilities wolves tend to choose red deer over boar, but will choose boar over roe deer (*Capreolus capreolus*) (Andersone and Ozoliņš 2004; Jędrzejewski, et al. 1992; Mattioli, et al. 2004). Due to their high meat yield and large autumn/winter herds red deer are often the ideal targeted prey, especially in heavy winter snows, but the hunting of boar comes with the added risk of dangerous tusks, while roe deer can be quite difficult to hunt due to their solitariness or small group size and quick, elusive nature. In all prey the young are overwhelmingly targeted and represent the highest percentage of age group killed by most observed wolf packs (Jędrzejewski, et al. 1992; Nores, et al. 2008).

Figure 7.1. Wolves walking over deep snow next to a sunken ungulate trail in Montana, USA (photograph: Doug Smith)

The Natural Hunting Ability of Dogs

While it is apparent not all of the natural hunting abilities of wolves were maintained through the process of domestication, hunting prowess in some dogs is still highly developed. Even puppies as young as six weeks old can successfully take visual cues from a human, an important skill when developing cooperative hunting methods (Riedel, et al. 2008). While it is clear from some observations that dogs are capable of preying on medium to large animals in feral populations, it seems much more common for them to prey on small game, and even more common that they depend on human refuse and remains from other predator kills for the majority of their subsistence. An instinctive ability to track, find, and chase prey, as wolves do, but a general inability to make a successful kill, especially with larger game, may be an evolutionary consequence of early domestic dogs' successful integration with human hunters. As they do now, dogs in the past likely provided the superhuman tracking and chasing capabilities, while humans, with their advanced weapon technology, made the final kill. It appears that the dogs who now maintain the ability to successfully prey on medium to large game, unaccompanied by humans, are primarily those who have sustained long-term, multi-generational independence from human reliance, and essentially mirror the behavior and ecology of wolves, such as dingoes.

While it is clear that the domestic dog has retained some of the wolf's innate hunting ability, the intensity and success of this aptitude varies. The continuum on which modern dogs exist outside the common household pet model ranges from fully wild to fully human dependent. The Australian dingo and New Guinea singing dog are typically considered completely wild breeds, dependent on only themselves for food and having little to no contact with humans. Though some are used by Aborigines as hunting aids, even these individuals are often described as living a fairly autonomous life away from the human group, only coming together to form a loose hunting partnership. In Australia dingoes have been observed independently hunting smaller animals like rabbits, rodents, birds, and lizards as well as larger prey like kangaroo, wallaby, feral pigs and cattle (Corbett and Newsome 1987; Mitchell and Banks 2005; Vernes, et al. 2001). Even in circumstances where dingoes have been observed being utilized as hunting aids for Aboriginal groups during the day, they often hunt for themselves at night (Finlayson 1943; Hackett 1937). Interestingly, while dingoes used for hunting have been observed foraging for themselves, introduced European-breed hunting dogs used by Aboriginal groups do not practice the same strategy, instead solely relying on food provided for them by humans (Hayden 1975). Because of the dingo's relatively small size the hunting of larger animals requires the cooperative hunting effort of a pack (Fig. 7.2). Although some dingoes are seen in small packs, it is quite common for them to exist solitarily and hunt smaller game, specifically rabbits, which have exploded in population since their introduction to the island. Like the wolf, dingoes go after prey that is high in population and easily caught (Corbett and Newsome 1987; Vernes, et al. 2001).

Figure 7.2. Two Australian dingoes teaming up to attack a kangaroo in Australia (photograph: Jean-Paul Ferrero)

Aside from the solitary Australian dingoes, New Guinea singing dogs, and other native single-breed dogs, there are dogs of variable breeds which exist on a spectrum of dependence and interaction with humans which are referred to as *wild, feral, free-ranging, free-ranging urban,* or *roaming*. These terms, from the most independent to the most reliant, also appear to come with their own limitations in hunting ability and success. Those animals which are truly *wild*, like the Australian dingo (when not part of an Aboriginal hunting group), tend to be completely devoid of human interaction and subsist on a diet of primarily wild game, caught by themselves. Similarly, *feral* dogs have little to no human interaction, but their diet may consist of a mixture of wild prey caught themselves, domestic livestock, carcasses, and garbage dumps. *Free-ranging* dogs are those that live in fairly rural environments, but may have increased interaction with humans in comparison to wild and feral dogs. They rarely take wild prey, though they may give chase. These dogs may be former pets that were abandoned or have run away and they subsist primarily on livestock carcasses, garbage dumps, and landfills (Fig. 7.3). Due to their close proximity to humans in cities and villages *free-ranging urban* dogs have more frequent human interaction, but are still ownerless and independent, though they may occasionally be fed scraps. They subsist primarily on garbage dumps and food waste disposed of by restaurants and local people (Fig. 7.4). *Roaming* dogs are those dogs which are owned and cared for by humans, but are often given the freedom to roam local areas, such as fields or forests. These are often rural hunting dogs and though they may give chase to wild game, they rarely make a kill and do not depend on food outside the home to survive.

Figure 7.3. Free-ranging dogs scavenging a garbage dump in Bangalore, India (photograph: Giridhar Narayan)

Figure 7.4. Free-ranging urban dogs being fed scraps by a local in New York City, USA (photograph: Regina Massaro)

Though there are occasional reports of feral dogs of mixed-breed ancestry successfully preying on larger animals, specifically ungulates (Hawkins, et al. 1970; Jhala and Giles 1991), these sightings are rare and the ability and success of domesticated dogs, even given a feral lifestyle, is clearly not comparable to the hunting prowess of their non-domesticated relative, the wolf, or even to wild dogs. Though feral dog kills of larger game are rare, they are not unheard of. In Illinois, USA a feral dog pack was observed chasing and killing white-tailed deer (*Odocoileus virginianus*) in a wildlife refuge. It was reported that they were responsible for 7% of the mortality of the deer population there, which could have been higher if the dogs numbers had not been artificially controlled (Nesbitt 1975). Similarly, in Idaho, USA it was reported that feral dogs had an effect on the deer population, particularly during the heavy snow of the winter season (Lowry and McArthur 1978), and feral dogs have also been observed successfully killing young mountain gazelle in Israel (Manor and Saltz 2004). Despite reports like these it is much more common for feral dogs to chase and harass medium to large wild game populations, but rarely catch them (Causey and Cude 1980; Progulske and Baskett 1958; Sweeney, et al. 1971) (Fig. 7.5). Non-wild domesticated dogs are far more effective predators of livestock (Fleming, et al. 2006) and small animals (Causey and Cude 1980; Kruuk and Snell 1981; Mitchell and Banks 2005; Scott and Causey 1973). They are even more effective scavengers of garbage dumps, landfills, carrion, and vegetation (Causey and Cude 1980; Green and Gipson 1994; Kruuk and Snell 1981; Scott and Causey

1973). The pronounced variation in domesticated dog hunting abilities, from the independent wild dog to the fully dependent pet dog suggests an important correlation between human interaction and dependency and successful hunting prowess. While feral, free-ranging, and roaming dogs clearly still maintain the drive and desire to chase larger game, it appears, for the most part that they are limited, either physically, behaviorally, or both, in their ability to complete the hunting task alone without the assistance of a human hunting partner to deliver the final kill (Ellen 1999; Nesbitt 1975; Progulske and Baskett 1958; Scott and Fuller 1965). This is no doubt the result of a process of coevolution which has lead to a codependence between hunting dogs and their human hunting partners whereby human hunters depend on dogs to extend their hunting capabilities, while the dogs depend on the human to make the actual kill.

Figure 7.5. Feral dogs chasing sambar deer (*Rusa unicolor*) in Madhya Pradesh, India (photograph: Satyendra Kumar Tiwari)

The Use of Hunting Dogs by Modern Human Hunters

While the natural hunting ability of most domesticated dogs may be limited when hunting alone, their skills can be amplified when utilized in conjunction with the methods and technology of human hunters. The ethnographic record, both from hunter-gatherer groups and modern sport hunters, exhibits the wide geographic and prey species range in which dogs are successfully utilized. Wild pig species are hunted for sport, control, or eradication across Europe (Braga, et al. 2010; Fernandez-Llario and Mateos-Quesada 2003; Rühe, et al. 2006; Saïd, et al. 2012; Scillitani, et al. 2010), the Americas (Cruz, et al. 2005; Garcelon, et al. 2005; Katahira, et al. 1993), and Asia (Kirino, et al. 2008), as well as by forager groups including those in the Andaman Islands (Cipriani 1966), Malaysia (Caldecott 1988), East Timor (Pannell and O'Connor 2010), Taiwan (Nobayashi 2006), South Africa (Mitchell 2008), The Philippines (Eder 1988), New Guinea (Bulmer 1968; Dwyer 1983; Lyons 1926), Indonesia (Ellen 1999), and Cameroon (Ngima 2006). Deer species are also commonly targeted by sport hunters, or for control and eradication in Europe (Martínez, et al. 2005; Olaussen and Mysterud 2012; Rühe, et al. 2006; Saïd, et al. 2012), North America (Campo and Spencer 1991; Chitwood, et al. 2011; Weckerly, et al. 2005), and Asia (Kamei, et al. 2010), as well as by forager groups including those in East Timor (Pannell and O'Connor 2010), Indonesia (Ellen 1999), Myanmar (McShea 2003), North America (Serpell 1995), South America (Di Bitetti, et al. 2008; Tate 1931), and Guatemala (Brown and Emery 2008). Other prey taken with the help of dogs include:

- duiker (Bailey 1991; Terashima 1983; Yasouka 2006)
- pouched rats (Lupo 2011b)
- forest rats (Ngima 2006)
- porcupine (Lupo 2011b; Takeda 1996; Terashima 1983; Yasouka 2006)
- mongoose (Terashima 1983; Yasouka 2006)
- genet (Takeda 1996)
- various monkeys (Pannell and O'Connor 2010; Takeda 1996; Vinnicombe 1976)
- antelope (Bleek 1928)
- gemsbok (Ikeya 1994; Liebenberg 2006; Mitchell 2008; Steyn 1984)
- eland (Vinnicombe 1976)
- water buffalo (Buxton 1968)
- hare and squirrel (Kent 1993)
- opossum (Dwyer 1983)
- ptarmigan (Kaltenborn and Andersen 2009)
- marsupials (Bulmer 1968; Lyons 1926; West 2005)
- moose (Blair 1911; Grøn and Turov 2007; Ruusila and Pesonen 2004)
- game birds (Littlefield 2006)
- cassowary (Lyons 1926)
- emu (Boyce 2006)
- guanaco and rhea (Gusinde 1937; Pferd 1987)
- species from the anteater family (Dantas-Aguiar, et al. 2011; Newton, et al. 2008; Tate 1931)
- species from the armadillo family (Alves, et al. 2009; Dantas-Aguiar, et al. 2011; Tate 1931)
- skunk (Alves, et al. 2009)
- peccary (Brown and Emery 2008; Gurven, et al. 2006; Koster 2008)
- paca (Gurven, et al. 2006; Koster 2008; Tate 1931)
- tapir (Koster 2008; Tate 1931)
- caribou (Laugrand and Oosten 2002)
- bear (Bischof, et al. 2008; Brody and Pelton 1989; Laugrand and Oosten 2002)
- fox (Liebenberg 2006)
- jaguar (Tate 1931)
- bison (Pferd 1987)

There are even ethnographic accounts of dogs assisting in the taking of fish, sea otter, and seal by means of in-water corralling (Pferd 1987).

Given the range of environments and prey types dogs are used to hunt around the world it is surprising that their utilization by modern foragers and sport hunting groups has not been more thoroughly examined in a cross-comparative analysis. Ethnographies which include descriptions of the human-dog hunting relationship often reveal the dog as a useful, and frequently essential, hunting tool without which many hunting groups would not have the ability to obtain their desired prey. This importance is further amplified by reports of exponential increases in meat yields and general hunting success paired with the minimized hunting risk and human labor required when practicing dog-assisted hunting. The dog's significance as a valuable and desired hunting aid is no more obvious than in the ethnographies of groups which had previously subsisted without dog-assisted hunting, but whose hunting strategies had been revolutionized by their procurement, leading in some cases to extensive changes in the prey hunted, labor division, and the entire structure of the society. In these and many other cases the regarding of hunting dogs as a valued fellow hunter and member of the group is obvious in the respectful treatment they are afforded and the reverent, human-like burials they are given.

The Dog as Hunting Technology

One of the key factors in shaping hunter-gatherer subsistence technology is the recognition of risk. Foragers carefully choose their technology in an effort to manage their energy in time and space and to prevent loss and failure (Torrence 2001). While hunting dogs are commonly listed among the important hunting tools used by groups in the ethnographic record (e.g. Ngima 2006), dogs are rarely discussed as a possible hunting tool in the archaeological literature, as evidenced by Oswalt's (1976) list of hunting tool types or Torrence's (2001) discussion of hunter-gatherer technologies. In her discussion Torrence (2001) defined a hunting weapon as that which restricts the mobility of prey, allowing the hunter to get closer for a kill. Certainly this description fits the superhuman skills provided by a dog in the assistance of a hunt. The natural abilities of a dog to sniff out, track, chase, and hold an animal – skills which are beyond the realm of human ability – all significantly enhance the capabilities and success of the human hunter. In this way dogs have become an important, and in some cases indispensible, hunting aid to many modern hunter-gatherer groups, as they may have been to hunter-gatherers in prehistory. Their use, sometimes alone and sometimes with other technology such as spears or guns, is a key factor in the minimization of subsistence risk and the maximizing of hunting returns and thus they are an invaluable extension of the hunter and his toolkit (Mitchell 2008).

One of the most important uses of hunting dogs seems to be as a replacement for a human hunter, freeing up people to perform a variety of other tasks. Mitchell (2008) stated that hunters in southern Africa used dogs to harry prey, a task previously assigned to one of the men, thus reducing human energy expenditure and allowing that man to perform other responsibilities. Researchers in New Guinea (Bulmer 1968) and Indonesia (Ellen 1999) noted that dogs were used as human substitutes to flush wild pigs from the brush, thus requiring fewer men to accompany the hunting party. Importantly, this role as a human replacement also allows for hunters to successfully hunt alone if their dogs are well-trained enough. The Tsou hunters of Taiwan successfully hunted for wild boar alone with a pack of hunting dogs (Nobayashi 2006) while it is said by the Mandari of Sudan that a water buffalo can be taken down by a single man with four dogs (Buxton 1968; Fig. 7.6). Pferd (1987) noted reports from 17th century USA of Native Americans sending their hunting dogs out to corral a moose, which the hunter could then kill alone. Dogs are also used to carry out a variety of hunting techniques that would be more difficult or impossible without their assistance. The most common of these is the locating and flushing out of game. In Malaysia the Sarawak used dogs to flush out prey and hold it down, a strategy to which they are indispensible and can virtually guarantee a successful day's hunt (Caldecott 1988). A similar strategy was used by the Efe of the Democratic Republic of the Congo (DRC)(Bailey 1991), the Etolo of New Guinea (Dwyer 1983), villagers in Brazil (Alves, et al. 2009), and sport hunters in Portugal (Braga, et al. 2010), among others. Dogs are also commonly used to chase-hunt and tree game (e.g. Nind 1831; Nobayashi 2006; Pferd 1987; Tate 1931; Terashima 1983). Chitwood et al. (2011) stated that sport hunters in North Carolina, USA used dogs to run white-tailed deer to the point of exhaustion, leading them to lie down as easy prey. One of the most valuable advantages of hunting dogs may be the holding of dangerous animals, reducing the risk encountered by the human hunter. Perhaps the most dangerous of the hunted prey is the wild boar, with its sharp tusks and habit of turning on a hunter, posting against a tree and fighting. Fearless, aggressive hunting dogs are a particular advantage in this situation, holding the boar so the hunter can get close enough for a kill, and many hunters prize these dogs above all others (e.g. Nobayashi 2006; Fig. 7.7). Other dangerous prey, such as gemsbok which attack predators with their sharp horns (Mitchell 2008; Steyn 1984), deer and kangaroo with violent kicks, venomous snakes, hyena, and jaguar are also more easily hunted with the use of a dog to mitigate the risk.

Figure 7.6. Mandari hunters of Sudan with their hunting dogs (photograph: Jean Carlile Buxton)

Figure 7.7. Hunting dogs holding a feral boar which has posted against a tree in Texas, USA (photograph: National Lacy Dog Association)

As useful as dogs have proven to be for some hunting techniques, their use is not always an advantage. Many hunters stress that dogs need careful training to become useful and that they must also be trained for the specific desired prey species and environment. Some dogs are simply not thought to have the proper personality for hunting (Caldecott 1988; Ikeya 1994) while others are separated into different types based on their specific ability (scent hound, aggressive attacker, etc.) (Alves, et al. 2009; Nobayashi 2006). In parts of central Africa dogs may be killed if they don't prove to be good and valuable hunters (Lupo 2011b). Although dogs can be trained to successfully hunt multiple species (e.g. Newton, et al. 2008), they can also prove problematic when blindly going after undesirable prey types (Koster 2008). In Italy hunting dogs are used to regulate wild boar populations, but uncontrolled or badly-trained dogs can cause significant disturbances to other local species such as bear, deer, and wolves (Scillitani, et al. 2010). Dogs can also be a disadvantage in the taking of certain prey or in certain environments. With the right training and communication dogs are valuable tools to hunt several species in Bolivia, but due to their loud nature they are considered a hindrance for locating and capturing wary arboreal monkeys (Gurven, et al. 2006). Likewise they are usually considered a hindrance when hunting in open habitats where prey is more likely to see them from a distance and flee (Mitchell 2008). For this reason many hunters insist that dogs should only be used for chase hunting and never for use while hunting from blinds or stalking (e.g. Mitchell 2008; Nind 1831).

And Then There Were Dogs

Though the practice of using dogs as a hunting tool has been a long-standing way of life in many hunting groups, the use of hunting dogs is a relatively new technology for some subsistence hunting peoples. This new technology is one which has revolutionized their hunting practices and success. Cipriani (1966) noted how the introduction of the dog to the Onges group of the Andaman Islands had transformed their hunting methods. Previously subsisting on fish and shellfish, the advent of dogs as hunting aids has allowed the group to prey on the more desirable wild pig. As a result the Onges have developed an intense affection for their dogs. Similarly, the Batak of the Philippines abandoned their traditional hunting technique of using blowguns for smaller prey in favor of spears and hunting dogs in order to hunt their preferred wild boar. It is only the recent decline of the wild boar population and capable hunting dogs which has caused a waning in this method (Eder 1988). By the 1980's the use of dogs had superseded the use of the bow and arrow as the preferred method of hunting for the !Xo of Botswana (Liebenberg 2006). In Australia and Tasmania the introduction of hunting dogs, specifically those of European origin, changed the way local forager groups interacted with their environment. Dogs brought to Tasmania by British colonists proved more important than guns, allowing Tasmanians to significantly increase their success in hunting kangaroos thus helping them compete with the colonists on the hunted meat market. In turn this successful partnership with dogs is also thought to have slowed down the progression of agricultural development in Tasmania (Boyce 2006). Jones

(1970) suggested the introduction of European dog breeds to Tasmania increased hunting efficiency so greatly that hunting pups became more important to the Aborigines than their own children.

In some parts of Australia introduced dogs have had similar effects to those in Tasmania. While the native dingo has been and certainly still is used for hunting (Berndt and Berndt 1942; Hayden 1975; Pickering 1992; White 1972), the introduction of European breeds, particularly hounds, has allowed for what is perceived to be even more successful dog-assisted hunting (Fig. 7.8). Because of the Yalata Aboriginal Reserve's location south of the dingo-proof fence the Aborigines there have incorporated introduced hounds, instead of the native dingo, into their hunting methods. They maintain that in their experience the European breeds act as superior hunting dogs which they treat with great care. The hunters in this area relied entirely on dogs for the taking of larger prey as their skill was so great in the hunting of kangaroo that White (1972) reported not one kangaroo was killed without the use of dogs. As a result of this success the traditional weapons of a spear and club were no longer used in favor of the easier method of hunting with dogs. Often the use of hunting dogs can be so effective that the surrounding populations of prey species are severely affected. Darwin (1839) noted that the use of the introduced hound to Australia was so effective in killing emu and kangaroo that the species were doomed to be exterminated if the use of hunting dogs continued. In Central and South America the use of dogs has been blamed for the extinction of several wildlife species in Panama and the use of hunting dogs has been banned in some parts of Brazil due to their devastation of local species (Ventocilla, et al. 1995). Ikeya (1994) noted that the San were forced to hunt further and further away from their camps as the increased hunter population with dogs had depleted all nearby prey resources. The raging debate between white-tailed deer sport hunters in the southern United States, where hunting with dogs has been banned in several states, centers on the argument that hunting deer with dogs is almost *too* easy (Campo and Spencer 1991). Those who encourage the ban on hunting dogs suggest that the effectiveness of a dog in successfully finding and chasing down a deer is so high that the practice cannot be considered a sport (Chitwood, et al. 2011).

Figure 7.8. Aboriginal women in New South Wales, Australia with an introduced European hunting hound (photograph: National Library of Australia)

The Value of a Hunting Dog

The use of dogs as hunting technology has proven an invaluable advance to many hunting groups. In the majority of ethnographic descriptions of hunting dogs the dogs have been associated with significant gains in the total success of hunts. The Bakola of Cameroon consider the hunting dog their most valuable domesticated animal and a hunting weapon that they cannot do without, a requirement. Their ability to hunt for meat, which is then used for trade, makes the dog a critical factor in the entire life of their small scale society (Ngima 2006; Fig. 7.9). In Australia, Giles (1889: 20) wrote that dingoes "make wonderful hunting dogs", while White (1972) said Aborigines at the Yalata Aboriginal Reserve rely on hunting dogs entirely. In Papua New Guinea, Dwyer (1983) wrote that access to a capable hunting dog was one of the critical determinants of successful Etolo hunting, while West (2005) stated that highly prized marsupials that live at high altitudes were impossible to hunt without well-trained dogs (Fig. 7.9). The Bambuti also said it would be impossible for them to track or kill certain types of game without dogs (Serpell 1995), as did the San (Ikeya 1994), the Sarawak of Malaysia (Caldecott 1988), hunters in the Guatemalan highlands (Brown and Emery 2008), and parts of South America (Tate 1931). Lewis and Clark (1814) also documented that dogs were critical to the hunting of birds by Native Americans in the United States.

Figure 7.9. Young Bakola hunters with a hunting dog (left; photograph: American Museum of Natural History) and hunters in Papua New Guinea with their hunting dogs (right; photograph: PBS Nature)

In many groups the owner of the successful dog, whether participating in the hunt or not, is entitled to a portion of the kill taken. For Aborigines at the Yalata Aboriginal Reserve (White 1972) and the San (Ikeya 1994) the entire kill belonged to the dog's owner while the Efe gave roughly 21% of the meat to the owner (Bailey 1991; Fig. 7.10). Bailey (1991) told of one particular Efe man who was ranked very low when it came to killing prey himself, but was one of the highest ranked in total meat procurement because he owned a very good hunting dog, which was involved in a large number of successful kills. Takeda (1996) stated that for the Ngandu in Zaire, a man who brings the dog that catches a monkey receives one of the monkey's arms in return. For any other animal which is caught with dogs, the majority portion of the kill is given to the owner. In Malaysia, where the wild bearded pig is the most important hunted species, over 86% of the pigs killed by the Sarawak were taken with the help of a dog (Caldecott 1988; Fig. 7.10), while Dwyer (1983) noted that the Etolo who hunt with dogs obtained proportionally more prey than those that did not. In Finland, where dog-assisted moose hunting for sport is common, hunters who used dogs obtained 56% more prey than hunters without dogs (Ruusila and Pesonen 2004),and Liebenberg (2006) has suggested that in the Kalahari (and perhaps as a general rule) the highest hunting success rates and meat yields were achieved by hunting with dogs. A famous example from Lee (1965) stated that one San man with a trained pack of hunting dogs brought in 75% of the meat for a camp, while six other hunters without dogs only brought in the remaining 25% combined. It is precisely this efficiency in hunting technique and improved hunting success that is thought to lead to the close relationship between dogs and hunter-gatherers (Clutton-Brock 1995; Serpell 1995).

Figure 7.10. Efe hunters with their hunting dogs preparing meat after a kill in the Democratic Republic of the Congo (left; photograph: Robert C. Bailey) and a Sarawak hunter with his hunting dog (right; photograph: Kho Chee)

Hunting Deer and Boar with Dogs in Temperate Deciduous Forests

While it is clear that dogs can be successfully used for hunting a variety of prey species, it seems their use is particularly valuable in the taking of ungulates. Not surprisingly ungulates are the most common prey type hunted by the dog's closest canid relative, the wolf, and the dog's innate ability to adapt and react to ungulate behavior makes them the ideal hunting aid. Of the ungulates hunted by both subsistence and sport hunters with dogs species of the *Suidae* (pig) (e.g. Braga, et al. 2010; Bulmer 1968; Caldecott 1988; Nobayashi 2006; Pannell and O'Connor 2010) and *Cervidae* (deer) (e.g. Chitwood, et al. 2011; Ellen 1999; Serpell 1995; Tate 1931) families are among the most common, although many subsistence hunters, specifically in Africa, also regularly use dogs to hunt members of the *Bovidae* (antelope, duiker, gazelle) family as well (e.g. Bleek 1928; Ikeya 1994; Ngima 2006). When hunting any prey it is important to understand the behavioral ecology of that species, something which modern, and presumably prehistoric hunters, are well attuned to.

While the ecology and behavior of deer can be variable, there are some distinct differences which affect the techniques used to hunt each individual species. The most common method of hunting deer with dogs is chasing, where dogs are either sent out to drive deer towards awaiting hunters or to trail a deer which has been wounded. Of the deer species one of the most obvious distinctions which may affect the methods used when hunting with dogs is the formation or lack of deer herds. The closely related red deer and sika deer (*Cervus nippon*) have strong social structures and typically form large same-sex herds during the autumn and winter, with fawns joining females and rutting males grouping together (Chaplin 1975; Fig. 7.11). As seen with wolves in the wild (Mattioli, et al. 2004), dogs used to hunt red or sika deer herds tend to target the weak or young members of the group, thus deer mortality rates for these species, when hunted with dogs, tend to be heavily skewed towards fawns in comparison to deer taken by hunters without the assistance of dogs. In contrast white-tailed deer and roe deer are much more likely to be solitary or live in very small (2-3 individuals) groups of females with fawns. Unlike red and sika deer, roe and white-tailed deer bucks do not form rutting groups. Owing to their smaller size white-tailed deer and especially roe deer are known for their quick and elusive nature, often leading hunting dogs on long chases which may end in escape or the dogs running the deer to the point of exhaustion and capture (Fig. 7.12). Like wolves, hunting dogs use deep, crusted snow in the fall and winter to their advantage against deer, forcing them into heavy drifts and making them much easier targets (Progulske and Baskett 1958; Fig. 7.13). This innate, wolf-like ability to adapt to deer movement is precisely why many hunters find hunting deer with dogs to be the most successful method. Novak et al. (1991) found that white-tailed deer in the US were 2.37 times more likely to be killed by hunters with dogs than those without and Rühe et al. (2006) found that 91% of red deer hunts in their German study were successful when hunters managed an unbroken acoustic tie with their hunting hounds. Dogs are also one of the main reasons for high wounded prey recovery rates among sport deer hunters who use them to track the blood trails of deer which have fled after being injured (Campo and Spencer 1991). Morton et al. (1995) reported that it took an average of only 30 minutes for hunting dogs to recover a deer once on the blood trail. The method is so effective that Norwegian law requires hunters to have a hunting dog available to track wounded red deer (Olaussen and Mysterud 2012).

Figure 7.11. A herd of red deer in Yorkshire, UK (photograph: Ron McCombe)

Figure 7.12. A roe deer displaying the trademark quick and nimble behavior (photograph: predator cats/Flickr)

Figure 7.13. Hunting dogs in northern Japan taking advantage of the limited movement of deer in deep snow (photograph: Nobuyuki Abe)

As evidenced by the significant number of both sport and subsistence hunters who use dogs to hunt wild boar, their use can be essential as boar are intelligent and can learn to evade capture quickly (Weeks and Packard 2009). Wild boar, like white-tailed and roe deer, typically live in small groups of females and young with males usually being solitary (Meriggi and Sacchi 2001). Additionally, like deer, piglets and their defensive mothers are particularly prone to predation by hunting dogs (Saïd, et al. 2012). The most important factor in the hunting of wild boar is the inherent risk associated with their dangerous tusks and bite. This is a risk hunters mitigate by using their dogs to chase down boar until they are forced into water where they can be killed (Caldecott 1988; Fig. 7.14) or they turn and post at which point dogs can hold the boar long enough for the hunter to make the final kill (Nobayashi 2006; Saïd, et al. 2012). Rühe et al. (2006) reported that 100% of wild boar chases from a study in Germany were successful when hunters managed an unbroken acoustic tie with their hunting dogs. This successful taking of wild boar requires skilled, aggressive dogs without which most hunters attested this type of hunting would be virtually impossible (Bulmer 1968; Dwyer 1983; Fernandez-Llario and Mateos-Quesada 2003; Garcelon, et al. 2005; Fig. 7.15).

Figure 7.14. A feral boar which has been forced into a creek by a pack of hunting dogs in Tennessee, USA (photograph: Tennessee State Library and Archives)

Figure 7.15. Aggressive hunting dogs corralling a boar so the hunter can shoot in Tennessee, USA (photograph: Tennessee State Library and Archives)

The importance of the use of dogs in dense temperate forests was no more apparent in this research than during the several hunting trips I observed while on fieldwork in Japan. These hunts took place on the eastern side of Honshu, in the same region where Jomon-period dog burials were located. They were led by local Japanese boar hunters who used dogs to track, chase, and hold boar. All of these hunters indicated that the hunting of boar in the region would not be possible without the use of dogs, primarily due to the difficulty of finding the boar, chasing them once they were on the run, and the danger of close contact with the animals. Due to Japanese law, hunters were required to make the final kill of the boar before sundown. The hunters indicated that it was important to start hunting early in the morning as the boar were less active during the daytime, meaning that it would be easier to surprise them while they were at rest. They also indicated that this made the boar much more difficult to find as they tended to rest in dense understory which provided ample concealment. This made the use of dogs even more important as boar were often only uncovered after dogs had sniffed them out of hiding.

The typical hunt started quite early in the morning when the dogs were leashed and lead through a forested area in search of signs of recent boar activity. The dogs would often lead hunters to patches of ground which showed signs of boar rooting (Fig. 7.16), or trees which boar had rubbed against (Fig. 7.17). At that point the hunters would determine how fresh the signs were and whether they should continue looking for boar activity or move to a different area. When it was determined that there were fresh signs of boar activity in an area the hunters encouraged their dogs to continue sniffing out the boar tracks. The dogs being used in the hunt were fitted with GPS tracking collars, which all of the hunters were able to monitor (Fig. 7.18). Once the dogs had caught on to a good scent they were released from their leashes and allowed to find the boar on their own. Using GPS tracking and the sound of the dogs' barking, the hunters would form a perimeter around the hunting area and work their way inwards towards the barking dogs. Hunters were often left quite a way behind the dogs as the temperate deciduous forest was very dense, and while dogs could move through it quite easily, the hunters often had to use machetes to cut through thick understory. The hunters could tell when the dogs had caught up to a boar based on the sound of their barking. Due to the dense vegetation, the dogs would continue to bark loudly once they had caught a boar, waiting for the hunters to arrive. Once multiple dogs had surrounded the boar, they would hold them by forcing them to post against a tree or restraining them with their mouths. Once the hunters arrived at the location of the boar and dogs they would deliver the final kill. On multiple occasions the kill consisted of a mother sow and her piglet (Fig. 7.19). The hunters indicated this was often the case, as dogs would chase the piglet and the mother would then defend her offspring.

Figure 7.16. A fresh sign of boar rooting in the soil the deciduous temperate forest in eastern Japan (photograph: author)

Figure 7.17. A sign of boar rubbing against a bamboo stalk in the deciduous forest in eastern Japan (photograph: author)

Figure 7.18. A Japanese boar hunting dog being fitted with a GPS tracking collar (photograph: author)

Figure 7.19. A mother sow and piglet killed after a dog-assisted hunt (photograph: author)

The high proportion of wild boar and deer (specifically white-tailed, roe, red, and sika) remains from many early Holocene hunter-gather sites around the world suggests that these groups would most likely have been utilizing dogs as hunting tools to maximize their hunting returns. The preferred habitat for these species is temperate woodland, specifically deciduous forests, where there is sufficient cover and access to vegetation on which to browse and forage. While increased vegetation productivity is thought to be a significant factor in increased deer populations (Melis, et al. 2009), wild boar are particularly sensitive to vegetation type, preferentially inhabiting areas with the densest cover (Saïd, et al. 2012). The rapid spread of postglacial temperate forests likely increased the total ungulate biomass which may have been a crucial variable in human behavior, organization, and populations in the early Holocene (Mellars 1975; Rowley-Conwy 1986). In contrast to coniferous forests which are poor in their ability to support animal life, the carrying capacity for ungulate species in a deciduous forest is approximately 1000-2500 kg/km^2 (compared to 200-500 kg/km^2 for pure coniferous forests), an optimal environment (Fitting 1968; Mellars 1975), or what Caldwell (1958: 8) has called “living country”. These areas of high-density, high-value prey species would have been ideal hunting grounds for prehistoric hunter-gathers, yet the density of the temperate forests and swiftness of the ungulates who inhabited them would have proved challenging in comparison to the open habitats and large herd animals of the glacial period. In this circumstance hunting dogs prove the ideal solution. In the US where sport hunters target white-tailed deer the deciduous forests can be so thick, requiring the use of a machete, hunting without a dog would be impractical (Chitwood, et al. 2011) and similarly the Nuaulu of Indonesia claimed their dogs were particularly useful in dense forested environments where their human sensory and locomotory skills were diminished (Ellen 1999). Both wild boar and deer have home ranges, an area of forest within which they prefer to stay, with deer having particularly strong attachments to a specific living area (D'Angelo, et al. 2003). In studies on the effects of hunting with dogs on the movement of deer populations red deer (and other group-dwelling cervids) left their home ranges for an average of six days before returning (Sunde, et al. 2009). In contrast more solitary deer like roe and white-tailed returned to their home ranges usually within one day of being chased away (D'Angelo, et al. 2003; Progulske and Baskett 1958; Sweeney, et al. 1971). This predictability in the return rates of hunted deer, allowing for a known reliable source of protein, has no doubt been taken advantage of by modern and prehistoric hunters. Campo and Spencer (1991) have reported that the population of white-tailed deer on dog hunted land in Texas, USA was seven times lower than that of still hunted (no use of dogs) land based on the effectiveness of hunting deer with dogs and the predictability of deer to stay within a preferred home range.

A Member of the Group: Care and Burial of Hunting Dogs

From the previous discussion it is clear that in many forager groups dogs have played a critical and unique role in assisting hunters, leading to hunting dogs acquiring an important status in the society. While the dog plays an important economic role as a valuable hunting tool, as a fellow social creature and intimate part of many hunting communities, it is not surprising that they are often considered a close member of the group. Many ethnographies cite the giving of proper names to dogs (e.g. Brown and Emery 2008; Ellen 1999; Hamilton 1972; Ikeya 1994; Lupo 2011b; Nind 1831; White 1972) as well as reverent treatment and admiration (e.g. Buxton 1968; Hamilton 1972; Takeda 1996). For the Ngandu in Zaire, dogs were so valuable they were given as part of a dowry and treated with respect (Takeda 1996), while at the Yalata Aboriginal Reserve in Australia people treated their hunting dogs as a sort of canine royalty with the best dogs being bestowed with titles such as “famous hunter” and “the most revered kangaroo dog” (White 1972: 201; Fig. 7.20). In the Guatemalan highlands hunting dogs were considered equal to their human hunting partners and were active in all parts of the hunt. Like the hunters themselves, dogs were introduced by name to the animal spirits and participated in ritual forgiveness ceremonies after the prey was killed (Brown and Emery 2008; Fig. 7.21). In several hunting groups the bond between humans and dogs even extends to the breastfeeding of puppies by community women (Hamilton 1972; Fig 7.22).

Figure 7.20. An Aboriginal Australian man with his prized hunting dog (photograph: LeRoux 1950)

Figure 7.21. A hunter in the Guatemalan highlands who has brought his hunting dog to ask forgiveness from the spirits of his prey (photograph: Brown and Emery 2008)

Fig. 7.22. An Aboriginal woman breastfeeding dingo pups (photograph: http://www.convictcreations.com/animals/dingo.htm)

In some places this close relationship leads to dogs being buried in remarkably reverential ways, quite similar to humans. In many societies those dogs which are useful for hunting are considered separate from all other dogs. In Australia, Berndt and Berndt (1977) described hunting dingoes which were treated as members of the family rather than personal property, and White (1972: 201) described revered Aboriginal hunting dogs as a sort of "canine aristocracy, except they do all the important work". Similar affection has been displayed for hunting dogs by the Onges of the Andaman Islands (Cipriani 1966), the Punan Dyaks of Malaysian Borneo (Harrisson 1965), the Vedda of Sri Lanka (Seligmann and Seligmann 1911), the Dorobo of Kenya (Huntingford 1955) and the Panaré in Venezuela (Dumont 1976). Though it is well known that some forager groups in the ancient past buried their dogs (e.g. Funk 2008; Larsson 1990a), suggesting a close human-dog relationship, it is less clear why they practiced this custom. Perhaps, as some modern hunting peoples do, they buried these dogs as an act of respect to a valued hunting companion and member of the group.

Among the Yurok in California, USA deer-hunting dogs were highly valued for their hunting prowess and were given a ceremonial burial on their death (Elmendorf and Kroeber 1960), as are some dogs from hunting groups in central Africa (Lupo 2011b). Upon the death of a man, the Gogodara of Papua New Guinea killed and buried his hunting dog along with him in the belief that the dog had a spirit as well (Lyons 1926), while elsewhere in Papua New

Guinea hunting dogs are given 'tree burials' (their bodies placed among the branches of a sacred tree) upon their death, as are their human counterparts (Koler-Matznick, et al. 2007). In Australia, both native dingoes and introduced European hunting dogs have been known to have been wrapped in paperbark and buried when they die (Gunn, et al. 2010; Meehan, et al. 1999; Fig. 7.23), and hunting dogs of the Tsou in rural Taiwan are often buried near their village, sometimes with a deer skin, when killed during a hunt (Nobayashi 2006). In Nigeria it is not uncommon for a hunting dog, in honor of the service it has provided, to be given an elaborate human-like burial, especially if the death occurred during a hunting expedition (Olowo Ojoade 1990). Grøn and Turov (2007) told of Evenk hunters in Siberia who treated their best hunting dogs as equals and buried them in traditionally human graves, believing they had human souls. The dog of one visually-challenged man in the camp was apparently such a good hunter he could chase a moose to within shooting distance of his master's tent. When the dog was killed by a bear he was given the elaborate burial of a friend and fellow hunter. And the burial of hunting dogs is not limited only to those that assist in hunting for subsistence. The burial of prized sport hunting dogs, specifically in the rural south of the United States, is common as evidenced by the popular Key Underwood Coon Dog Memorial Graveyard in Alabama (Fig. 7.24) and the bird dog cemetery at Di-Lane Plantation in Georgia.

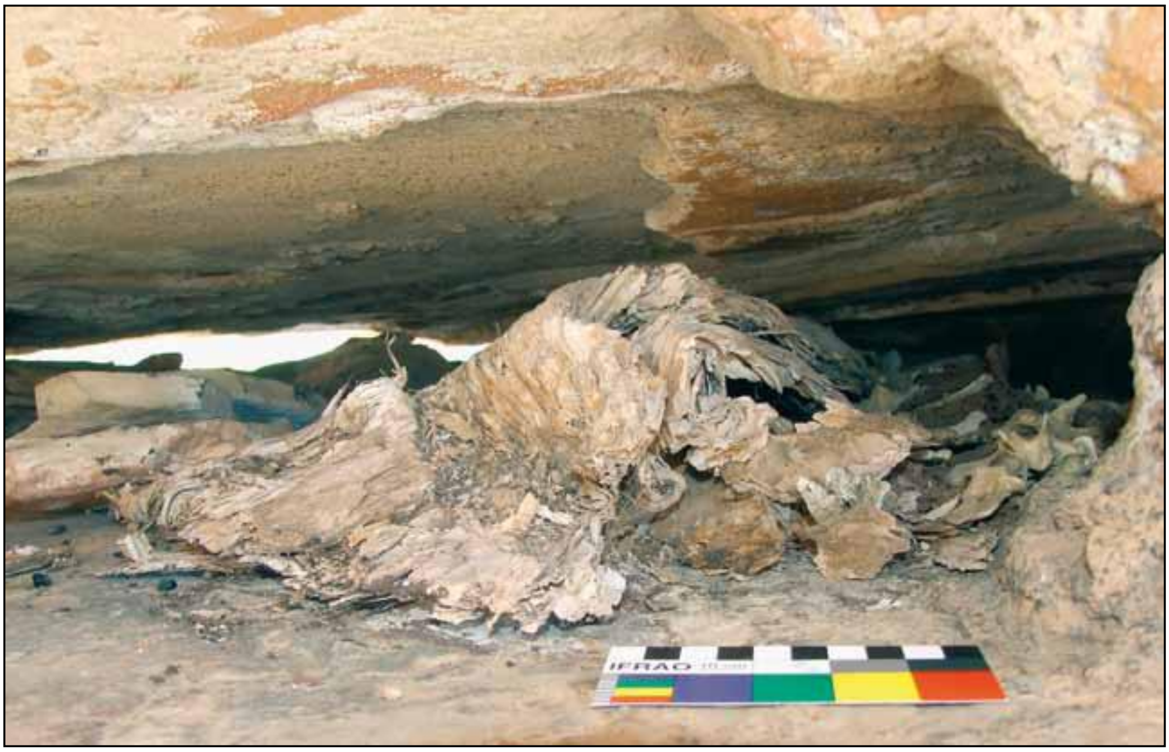


Figure 7.23. A paperbark dingo burial in Australia (Gunn, et al. 2010)

Figure 7.24. Entry sign to the Key Underwood Coon Dog Memorial Graveyard in Alabama, USA (photograph: American Houndsmen)

Implications for Hunting Dogs in Archaeology

While the argument for the regular use of hunting dogs during the prehistoric period has been made previously by researchers, evidence for this use is often circumstantial and assumed through a variety of other archaeological material. A high proportion of dog remains at sites with evidence for intensive microlith use and ungulate subsistence is one of the primary arguments for the utilization of hunting dogs, especially given their obvious value to some modern hunting groups (Aaris-Sørensen 1977; Clutton-Brock 1984; Morey 2010). In temperate areas where the environmental change was most significant during the early postglacial period, specifically southeastern parts of the United States, northern Europe and eastern Japan, the faunal evidence speaks volumes. In all of these areas the primary terrestrial prey species utilized were medium-large ungulate, specifically deer and boar. Perhaps unsurprisingly, these areas also display large clusters of careful dog burials which have been deposited with hunting-related grave goods (Perri 2010). As evidenced by many ethnographic accounts the risk in hunting these temperate forest ungulates is greatly reduced with the use of a dog, which can often maximize the meat yield far beyond that which is capable without a dog. Using his own ethnographic hunting correlations, Caldecott (1988) in his discussion of the prehistoric hunting record in Malaysia argues that the high proportion of wild boar identified from archaeological sites would have been impossible to take without the use of hunting dogs. And the procuring of meat may not have been the only important use of dogs to maximize hunting returns. The pressure to provide deerskins for clothing in the cold winter months, in the absence of hides from domesticated animals, may have been an additional stress on success in hunting deer as evidenced by Native American groups in the northeastern USA (Gramly 1977).

So what can the use and relationship between human hunters and dogs in the modern period tell us about these relationships in the postglacial past? A common motive given for the domestication of the dog is for use as a hunting aid (e.g. Clutton-Brock 1984; Davis 1982; Downs 1960; Fox 1978; Zeuner 1963). It is argued the archaeological record shows that hunting was one of the earliest economic functions for dogs (Serpell 1995), and Clutton-Brock (1984) suggests dogs were heavily utilized in the early Holocene, not long after their domestication, in concert with new microlithic technology to track and retrieve wounded game in difficult forested environments. Evidence from the ethnographic record certainly makes a strong case for the value of hunting dogs to both subsistence and sport hunting groups, especially in the targeting of the ungulate prey species that dogs are innately prone to hunt. In the early Holocene world hunter-gatherer groups who had previously survived hunting primarily megafauna or large herd game such as caribou in open glacial habitats would have been confronted with a rapid environmental change to denser temperate deciduous forests populated with prey species that required a significant adaptation in their hunting methods. In this change of both environment and prey type, the advantage would have shifted from human hunter to prey animal. From large congregations of herd animals which could be ambushed in an open environment to those which were quicker, more solitary and moving through dense forests, prey behaviors and surroundings which would have proved challenging to humans' limited sensory and locomotory skills. In this situation a dog, which could reduce hunting risk by sniffing out and tracking prey, communicating prey location through barking and holding down prey which was being chased would be a extremely valuable asset to a hunting group. This importance as a hunting aid could have led to hunting dogs in the past being considered as equivalents to human hunters in the group, as they often are in modern forager groups.

Since native subsistence hunting groups no longer inhabit the oak-based temperate forests of the United States, northern Europe or Japan the closest proxy to understanding human hunting behaviors in the early Holocene of these areas are the ethnographies collected from modern sport hunters and from subsistence hunting groups in other densely forested environments around the world. While the red deer, roe deer, and sika deer which were hunted in abundance by foragers in the early Holocene now primarily inhabit forests outside the range of native subsistence hunters, the various subspecies of wild boar are still common prey animals for many modern subsistence hunting groups. Although the specific hunting methodologies and weaponries used by modern foragers in combination with hunting dogs are a source of valuable information, as is an understanding of dog-prey behaviors, the ecology of different prey species, and interactions within different hunting environments, it is the documenting of the intangible personal interaction between dog and man, the codependent relationship that exists between human and animal hunter that is perhaps the most beneficial in understanding the potential relationship between hunting dogs and foragers in the past.

Conclusions

It is clear from the ethnographic record that given the proper training dogs can be useful for hunting a variety of wild game. Given the behavioral ecology of the dogs and prey species in combination with certain environments, dogs certainly seem to be more useful in hunting methods which utilize their natural propensity for tracking, chasing, and holding prey. In contrast they can prove to be a detriment in the taking of game in open landscapes where they can be seen easily or methods which require quiet stealth and ambushing. Most modern hunting groups who successfully use hunting dogs have found that their assistance is vital to minimizing hunting risk and maximizing meat yields and many hunters, both subsistence and sport, indicate that the hunting of their desired prey would be difficult or impossible without the use of hunting dogs. Groups which have only recently acquired hunting dogs have often seen a significant increase in their hunting success which has allowed them to target more desirable game as well. This importance as not only a revolutionary hunting tool, but also as an esteemed hunter has led to many hunting dogs acquiring an elevated status with some even receiving respectful, human-like burials.

The application of observations from human-dog relationships in modern hunting groups to human-dog hunting relationships in the past can be complicated, yet it is these modern relationships which may prove to the most insightful. Ethnographies from all over the world indicate that dogs are valuable, often indispensible, hunting tools. Their use is especially effective with quick, solitary prey, like ungulates, in dense forested environments which minimize human sensory and locomotory awareness. It would be unlikely that early Holocene foragers in temperate deciduous forests, with an intimate connection to their surrounding environment, thorough understanding of prey species ecology, and a desire to maximize hunting returns while minimizing risk would not make use of the natural hunting tendencies of their domesticated dogs. The pattern of high deer and boar remains from archaeological sites in early Holocene deciduous forests in parallel to a high number of elaborate dog burials with hunting-associated grave goods at the same sites further suggests there is a close connection between the hunting of ungulate species and the use of dogs as hunting aids in the past.

Chapter 8: Discussion

Introduction

There are many challenges in ensuring the comprehensive and systematic comparative evaluation of global data sets, yet the value in assessing similar cross-cultural archaeological phenomena is important to future research. This thesis does not attempt to summarize in totality the archaeology of the Archaic midsouth United States, Mesolithic northern Europe or Jomon eastern Japan, nor does it attempt to deal with the entirety of Pleistocene-Holocene climate change, hunting adaptations, or the nature of the burial of dogs across the archaeological record. Instead, it aims to highlight a cultural adaptation associated with dramatic climatic and ecological change, which evolved in parallel across geographically and culturally unrelated groups. This research has argued that (a) in the modern and ethnographic record, some dogs have been used as a vital part of a dense temperate forest hunting strategy, which suggests that this was a method that was likely employed by early Holocene hunter-gatherers in similar environments, and (b) the large clusters of isolated dog burials observed in each of the discussed regions are the result of the elevated status earned by some hunting dogs as formidable weapons and valued members of the social group.

These isolated dog burials are neither offerings accompanying deceased human individuals, nor mere carcass disposals, but are themselves interred similarly to humans at each site from which they are found (see Chapter 3). These burials appear nearly simultaneously among culturally and geographically unrelated early Holocene complex hunter-gatherers in three distinct locations: the midsouth United States, northern Europe and eastern Japan; coinciding with the onset of significant postglacial warming that triggered dramatic environmental change throughout the northern temperate zone; specifically the establishment of temperate deciduous forests. Along with this new environment came new prey species, and with the new prey species important hunting adaptations by humans. This research has presented a previously unidentified link between the first worldwide occurrences of individual, intentional dog burials and changes in hunting environments and prey species brought about by early Holocene climate change. Ethnozooarchaeological work with modern hunters and other ethnographic material (see Chapter 7) confirms the use of hunting dogs in temperate deciduous forests as a preferred method which yields improved results, in contrast to boreal forests or open tundra, where dogs can be a detriment. In densely forested environments, prey species often rely on concealment, rather than flight, to escape predators and human hunters. Dogs give vital assistance to hunters in these conditions, performing superhuman tasks such as locating concealed prey, tracking wounded animals, and bringing them to bay. In contrast, dogs are less useful to hunters in open country, where they can be seen at long distances by potential prey animals, or in boreal forests where smaller prey species or megafauna were primarily exploited (see Chapter 2).

In each of the three geographic areas, the individual burials (referred to as 'isolated burials'; see Chapter 3) began nearly simultaneously with the onset of early Holocene warming, which saw the eventual spread of oak-based temperate deciduous forests across the northern temperate zone. With these forests came the medium-sized ungulate species that inhabited them – primarily various deer species and wild boar. This work suggests that one of the strategies employed to hunt these new species was the use of dogs as a risk-reducing, kill-maximizing hunting tool. This hypothesis is supported in part by the fact that every site at which individual dog burials are found, deer and/or wild boar are the most abundant terrestrial prey species recovered from the associated faunal deposits (see Chapters 4-6). This thesis has explored the idea that forager groups living in these new forested environments took advantage of dogs' natural propensity to track and chase-hunt prey, and thus became valued members of the group, with some earning human-like burials upon their death. This study presented a pattern in which individual dog burials began during the early Holocene in each region and then increased in both site and burial numbers through the mid-to-late Archaic/Mesolithic/Jomon periods. Perhaps most suggestive of the relationship between environment, hunting, and isolated dog burials is evidence of these burials ceasing with the advent of agricultural subsistence in each area, an event which happened at a different time in each location (see Chapters 4-6). The sudden, contemporaneous occurrence of dog burials in these three culturally and geographically distinct areas implies a fundamental relationship between early Holocene climatic warming and the use of dogs in hunting. In these dense, temperate forests dogs would have minimized hunting risk and helped to ensure the survival of the human groups with whom they lived. In return they were regarded as essential members of the social group, earning burial similar to that of their human counterparts. In each area, this relationship continued through the hunter-gatherer period. These results show that groups of hunter-gatherers who were culturally unrelated and broadly geographically distributed were adapting to the warming environments of the early Holocene in remarkably similar ways.

Additional Dog Burial Information

One of the difficulties in comparing data from multiple burials, sites, regions and cultural groups is the lack of an analogous approach, especially in the analysis and descriptive reporting of the archaeological materials (see Chapter 3). As the excavation of the burials described throughout this thesis ranged from the 19th century to very recent, regional archaeological norms and personal interests of the excavators have colored the information collected and reported from the burials. Although there have been recent suggestions for the systematic collection of information upon the discovery of archaeological dog remains (Crockford 2009), the description and analysis of these mortuary treatments is still incredibly neglected. In the dog burial data appendices for each region (see Appendices 1-3), in addition to the number of individual dog burials excavated, I have included information about (1) whether the site was located on a shell midden (SM); (2) records of injuries, trauma pathology on the dog bones (INJ); (3) the presence or absence of a prepared grave pit (PP); and (4) the presence of grave goods (GG) included with the burial of the dog. While at least some of this information has been provided for most dog burials, there are many sites in which the excavators provided little to no detail. In these cases the information is left blank. An analysis of this quantitative information provided the following information for those attributes which have been reported:

(a) *Shell middens*

The presence or absence of a shell midden has been reported from every site examined in the total survey (n=85). In the United States 75% of the sites were shell middens. In northern Europe over 33% of the sites were shell middens. In eastern Japan over 94% of the sites were shell middens. Combined from the total survey, over 81% of the sites were shell middens. Those sites that were not shell middens were rockshelters (United States, n= 2; Japan, n=1), caves (United States, n=2), or open habitation sites (United States, n=6; Europe, n=4; Japan, n=1).

(b) *Injuries*

For a full discussion of injuries, trauma and pathologies on isolated dog burial remains, see Chapter 3. While the reporting of injuries on the dog bones was meticulous in some cases, especially those which offered a full faunal report of the site, others provided no information. In total 25% of the sites from United States, over 66% of the sites from northern Europe, and over 82% of the sites from Japan did not provide injury information. Overall, over 54% of the total sites surveyed did not have reported dog injury information. Of those sites that did have information, injuries were reported on 10% of the dogs from the United States, 0% of the dogs from northern Europe, and 18% of the dogs from Japan. In total, there were injuries from 13% of the dogs from which site information was available across the total survey.

(c) *Prepared pits*

For a full discussion of the inclusion of prepared grave pits for dog burials, see Chapter 3. It is important to note that some dog burials included obviously prepared pits dug into the soil, but other isolated burials may have only comprised of a dog being put in a shell midden and covered with a shell layer, as was done with human remains, which would be invisible in the record. Like the injuries, not all sites have information about the use of prepared pits for dog remains. Information on prepared pits is not provided from 25% of sites in the United States, over 66% of sites from northern Europe, and over 69% of sites from Japan. In total it is not reported from over 48% of the total survey. From those sites which prepared pits are reported, they are present at over 32% of sites in the United States, over 33% of sites in northern Europe, and over 30% of sites in Japan. In total, they are present from over 31% of sites from which prepared pit information is reported.

(d) *Grave goods*

For a full discussion of the inclusion of grave goods with dog burials, see Chapter 3. Like the other burial attributes, information about grave goods with dog burials was not always reported. Grave good information has not been reported from 25% of the sites in the United States, over 66% of the sites in northern Europe, and over 94% of the sites in Japan. From those sites which have provided information on dog burial grave goods, they have been included at 15% of sites in the United States, over 16% of sites in northern Europe, and over 5% of sites in Japan. In total, they have been included in over 10% of sites from which they have been reported in the total survey.

Appendix 4 has assembled the qualitative descriptions of these dog burial attributes. In this discussion, 'n' refers to the number of sites from which dog burials display a particular variable, and not the number of individual burials which display that variable, unless otherwise stated. This is the result of some site literature being unclear about whether descriptions refer to one or multiple dog burials from the site. Of the injuries reported, accounts of well-worn teeth are one of the most common (n=4). This is likely due to the advanced age observed from many of the dog remains. Mandibular infection was reported from some burials (n=2), as well as broken, healed, or curved vertebral bones (n=4). The most numerous injury was broken and healed limb bones (n=5), and there was also a site with a broken and healed baculum (n=1) and ribs (n=1). There were a few sites with dogs that had evidence for arthritis (n=2) and a couple of sites which only had reported 'healed broken bones' (n=2). Overall, many of the injuries suggest they are the result of age or repeated stress on bones and joints as a result of activities, such as hunting, which can cause arthritis (Acker and Fergus 1994; Terlep 2002). Warren (2000; 2004) has discussed the possibility that extensive limb bone and other injuries observed in early Holocene dogs may be the result of dangerous interactions with forest ungulates, as observed in modern hunting dogs and wolves (see Chapter 7 for further discussion).

While grave goods have not been commonly noted among many of the isolated dog burials, which is not surprising given the lack of grave goods among many transegalitarian societies, there are some notable exceptions. A number of sites (n=4) have had some kind of marker indicating the presence of the dog grave, including a limestone slab cover, a stone slab 'coffin', a tumulus of dolemite rocks, and a layer of stones. Other grave goods include stone picks, projectile points, and debitage (n=5), bone tools (n=2), elements from other animals (including red deer antler; n=2), a metate/mano set (n=1), red ochre (n=1), and an oyster shell bracelet (n=1). While grave goods have been found included with isolated dog burials of all ages, including with a 6-7 month old puppy (Horikoshi 1977), a number have been recovered from dogs which were described as 'old' or 'advanced' in age (n=3; Bentz 1988; McMillan 1970; Otake 1983).

Additional information included in Appendix 4 consists of notes on the burial position, approximate size and ages of the dogs. Though only some dogs (n=5) have had their burial position specifically described, this can also be interpreted from in-situ excavation photographs, many of which depict a similar position described as *placed positioning* in this thesis (see Chapter 3). This has variously been referred to as 'curled' (Lewis and Lewis 1961; Toki 1936), 'sleeping position' (Webb and DeJarnette 1948b), 'semi-flexed' (Dowd and Breitburg 1989), and 'natural sleeping position' (Haag 1948; Webb 1939) in the literature of these sites. Notation of the approximate size of dogs has also been made by several researchers, notably in relation to sizes of modern dog breeds. In the United States there have been references to dogs of small Beagle or terrier-size (Bentz 1988; McMillan 1970; Morse 1967), as well as Husky-sized (Morse 1967). From the Japanese sites, dogs have been described in reference to the modern Japanese Shiba Inu breed (Horikoshi 1977; Oikawa 1980; Sumiyoshi 1981). In more general terms, dogs from the United States have been described as 'very large' (Lewis and Lewis 1961), 'small' (Griffin, et al. 1974), and 'extremely small and lightly built' (Morse 1967). One intentionally buried dog, from the Mesolithic site of Ertebølle, was described as being a different breed from the isolated dog elements at the site, with strong limb bones and stout metapodials (Winge 1900). Perhaps most interesting is the variation between ages of the dogs included in isolated burials, which range from very young to very old. Again, not all sites have literature discussing the ages of their isolated burials, but from those that do there are dogs described as 'newborn or fetus' (n=1; Kaneko 1977), 2-3 months (n=1; Hirasawa 1986), 3-4 months (n=1; Sudo 1985), 6-7 months (n=1; Horikoshi 1977), 3-4 years (n=1; Nishino and Okazaki 1971), 4-5 years (n=1; Kusama and Kaneko 1971), 5-6 years (n=1; Nishino and Okazaki 1971), and over 12 years (n=1; Nishino and Okazaki 1971). Furthermore, the ages of some dogs have been described more generally, such as 'puppy' or 'young' (n=5; Breitburg 1983; Hasebe 1952a; Hirasawa 1986; Jonsson 1985; Nagamatsu 1976; Saito 1952); 'mature' or 'adult' (n=10; Breitburg 1983; Editorial Committee and of the Report of Ikawazu Shell Midden 1972; Hasebe 1952a; Horikoshi 1977; McMillan 1970; Morse 1967; Nagamatsu 1976; Parmalee 1959; Saito 1952; Sato 1995b; Walker and Morey 2005); and 'old', 'very old', or 'advanced age' (n=7; Bentz 1988; Dowd and

Breitburg 1989; Editorial Committee and of the Report of Ikawazu Shell Midden 1972; Hirasawa 1986; Oikawa 1980; Otake 1983; Parmalee, et al. 1972).

In discussing these dog mortuary attributes it is important to note their conservative nature. Many of these sites were excavated in the 19th or early 20th centuries, before the frequent application of zooarchaeological analysis, suggesting the details of additional dog mortuary treatment may not have been noted or reported. In fact, even in modern archaeology intentionally-buried dog remains often go unreported or lack description beyond the identification of their presence (Crockford 2009). Given this, it is fair to imply the record of prehistoric dog mortuary behavior, including the number of burials themselves, is much richer than has been reported. Nonetheless, the attributes presented further support parallels in both the treatment of dogs within each group and the environment (natural and cultural) within which these isolated burials occur. This discussion highlights parallels described throughout this thesis and in the additional data provided in the appendices, further emphasizing the relationship between complex hunter-gatherers, early Holocene climate change, hunting adaptations and the isolated dog burial phenomenon in the Archaic midsouth United States, the Mesolithic northern Europe, and Jomon eastern Japan.

Early Holocene Complex Foragers and the Pleistocene-Holocene Transition

Definitions of terms such as 'hunter-gatherer' or 'complex' have long been at the center of archaeological discussion and debate (e.g. Arnold 1993; Arnold 1996; Hayden 1996; Keeley 1988; Pearson 2007; Petersen and Meiklejohn 2007; Renouf 1989; Rowley-Conwy 1983; 1998a; 2004; Sassaman 2004; Smith 2012; see Chapter 2). Although Arnold (1993; 1996; 2001) and others have often argued the term 'complex hunter-gatherers' should be reserved for groups where there is clear leadership, social status, and control over non-kin, the more common use allows for a broader meaning which includes sedentary transegalitarian foragers. This use of the term 'complex hunter-gatherers' and its accompanying issues were well summarized by Price (2002: 418):

> *… in spite of almost 20 years of discussion, the concept of complexity among foraging groups is not well defined. There is a general consensus that complexity means bigger groups, longer stays, more elaborate technology, intensified subsistence, broader residential utilization, and the like.*

In contrast to Arnold, Binford (2001) suggested complex hunter-gatherer groups did not tend to be based on status or ranked hierarchies, and proposed that 'the idea that complexity always results in the division of leadership into elite or privileged persons and the disenfranchised is a vestige of linear evolutionary projectories' (2001: 463). Following this list of 'complex' traits outlined by Price (2002), Pearson (2007) has suggested cultural similarities between the hunter-gatherer groups of the Archaic midsouth United States, Mesolithic northern Europe, and Jomon eastern Japan. Similar comparisons across the three cultures have been drawn by other researchers as well (Aikens, et al. 1986; Hayden and Gargett 1990; Nishida 1983; Petersen and Meiklejohn 2007; Zvelebil 1986), including Rowley-Conwy (1998a) who suggested sedentary transegalitarian hunter-gatherers tended to be high-latitude coastal groups. While the Archaic shell midden groups of the midsouth United States were not coastal, the aquatic productivity of the extensive Mississippi River tributaries which they inhabited certainly matched or exceeded that of the northern European or Japanese coastlines (see Chapter 4). While some of the ecological and cultural parallels between the three groups have been noted in the archaeological literature, these similarities had never been examined to the degree presented in this thesis.

Following the Pleistocene-Holocene transition, which introduced bio-productive deciduous forests and abundant aquatic resources due to sea level rise, these groups emerged in resource-rich regions and flourished (see Chapter 2). Zvelebil (1986) has stressed that the temperate zone offers a range of choices for the development of post-glacial adaptations that are not possible in other regions. When describing the temperate forests, in reference to postglacial hunter-gatherers, he outlined four distinguishing features including (1) marked seasonal variability of resources, caused by variation in temperature, rather than precipitation; (2) low general diversity of animal species, but high diversity of middle-sized ones; (3) high productivity of coastal and riparian zones and (4) the presence of plants with storage organs within a mature ecosystem (roots, tubers, nuts) (Zvelebil 1986: 2). Schalk (1981) proposed that the clumping of aquatic resources in the temperate zone was related to larger groups, delayed return consumption, and increased complexity, while Testart (1982) argued that food storage among complex hunter-gatherers was a reason for forager sedentism in these highly seasonal regions. Several researchers (e.g. Parkinson 2002; Pearson 2007; Yerkes 2002) have discussed this increase in complexity among hunter-gatherers in terms of 'tribal' societies, with Pearson (2007: 379) making a specific comparison between the Jomon in Japan and the Archaic shell mound groups of the midsouth United States. Parkinson (2002: 1) argued that this concept of tribe 'deals with some degree of institutionalized social integration beyond the level of extended family unit or band', but without hierarchy or political control as seen in later state-level groups.

In the early Holocene an attraction to more reliable and predictable resources, specifically aquatic resources, led to the rise of sedentism and increasing socio-economic complexity among certain hunter-gatherer groups in the northern temperate zone (e.g. Brown 1985; Keeley 1988; Koyama 1979; Rocek and Bar-Yosef 1998; Rowley-Conwy 1998a; Watanabe 2007). Growing populations and population densities, as a result of sedentism, around these static resources (Keeley 1988; Keeley 1991; Rowley-Conwy 2001) increased resource pressure and stress, leading to intergroup violence and increasing territoriality (see Chapters

4-6). The notion that an archaeological cemetery, as observed in the three discussed regions, probably indicates a territorial group has long been argued (e.g. Albrethsen and Petersen 1976; Goldstein 1981; Larsson 1994; Pardoe 1988; Rowley-Conwy 2001; Saxe 1970). This theory, initiated by Saxe's (1970: 119) famous 'Hypothesis 8', claimed that 'to the degree that corporate group rights to use and/or control crucial but restricted resources are attained and/or legitimized by means of lineal descent from the dead (i.e. lineal ties to ancestors), such groups will maintain formal disposal areas for the exclusive disposal of their dead, and conversely'. Later, Goldstein (1981: 61) reframed Saxe's original hypothesis into three sub-hypotheses:

(a) To the degree that corporate group rights to use and/or control crucial but restricted resources are attained and/or legitimized by lineal descent from the dead (i.e. lineal ties to ancestors), such groups will, by the popular religion and its ritualization, regularly reaffirm the lineal corporate group and its rights. *One* means of ritualization is the maintenance of a permanent, specialized, bounded area for the exclusive disposal of their dead.

(b) If a permanent, specialized, bounded area for the exclusive disposal of the group's dead exists, then it is likely that this represents a corporate group that has rights over the use and/or control of crucial but restricted resources. This corporate control is most likely to be attained and/or legitimized by means of lineal descent from the dead, either in terms of an actual lineage or in the form of a strong, established tradition of the critical resource passing from parent to offspring.

(c) The more structured and formal the disposal area, the fewer alternative explanations of social organization apply, and conversely.

Though there have been arguments against the Saxe/Goldstein Hypothesis (e.g. Hodder 1984; Shanks and Tilley 1987), the premise of cemeteries being representative of territoriality and control over static resources through ancestor lineages appears to be applicable to each of the complex hunter-gatherer groups described throughout this thesis (see Chapters 4-6). The permanent, bounded cemeteries which exist from the Archaic, Ertebølle and Jomon cultures, often manifested in the form of monumental shell middens, likely acted functionally as a place for the disposal of the dead, but symbolically as a connection to ancestral rights to nearby static resources. This was a result of groups wanting to take ownership of resource-rich areas which were prone to overexploitation. This territoriality grew as populations grew, with ever increasing hunting pressure on forest ungulates, which appeared to be the preferred prey (e.g. Hawkes, et al. 2001; Lee and De Vore 1968; Magnell 2005; Mellars 1975; see Chapters 4-6). Importantly, in addition to displays of territoriality, Rowley-Conwy (2001) and Torrence (2001) have both stressed that when resources have to be procured in a short period, due to seasonality, hunting pressure or both, technology becomes more specialized. A positive association between increasing social complexity and technological complexity, diversity and efficiency has also been identified by a number of other researchers (e.g. Adams 1966; 1996; Boserup 1966; 1981; Fitzhugh 2001; Fried 1967; Oswalt 1982; Service 1962). Davidson (1989) and Torrence (1989) have both stressed the importance of reducing the risk of failure when dealing with a short seasonal hunting schedule, emphasizing that every hunting episode needs to be successful. This would be even more important as hunting territories shrank and terrestrial game became stressed due to local overhunting. The advent of microliths, seen in all three regions, was one technological innovation which reduced risk and specifically target medium-sized forest ungulates (see Friis-Hansen 1990). In strong association with the use of microliths and the bow and arrow, the use of hunting dogs would have amplified hunters' ability to extract terrestrial game, with the least amount of risk.

Though the early Holocene temperate deciduous forests were undoubtedly more productive than the polar tundra or boreal forests of the late Pleistocene, seasonal availability of resources, sedentary or semi-sedentary habitation and growing populations in the three cultures put pressure on local resources, which became particularly problematic when there was a catastrophic failure, such as a bad acorn mast (which affected groups' nut collection, as well as the diet of the ungulate prey species) or outbreaks of disease amongst prey species. The abandonment of a highly-mobile lifestyle meant that alternative solutions had to be found to deal with times of resource stress, such as broadening the dietary spectrum, storage, intensification of hunting strategies, `and displays of resource ownership through monumental cemeteries. This resource stress would have become even more intensive as populations continued to grow and territories shrank, bringing groups competing for resources into more constant contact. Evidence for violence and warfare among these territorial groups supports the idea of growing competition for resources (Kobayashi, et al. 2004; Meiklejohn and Zvelebil 1991; Smith 1993a; Thorpe 2003; Turner 2006). During this period, the minimization of risk and uncertainty through various efforts, including intensifying hunting methods, was important in regards to increasing resource competition. This suggests that while dogs may have served as an important new technological innovation at the beginning of the early Holocene, their use and value likely intensified throughout the early Holocene, as populations continued to increase, shrinking territories and putting additional stress on local terrestrial resources. In this circumstance, when resources were being increasingly depleted (Jefferies, et al. 2005; Koike 1986; Magnell 2006; Noe-Nygaard 1974; Rowley-Conwy 2001), hunting dogs would have proved the definitive hunting weapon, maximizing kills while minimizing risk.

Risk, Uncertainty, Hazards and Resilience

The difficulty of relating past human activities and cultural phenomena, such as the use and subsequent burial of hunting dogs, to environmental change has long been a point of debate amongst archaeologists. The crux of this challenge is best described in an important comment by Barton et al. (2007: 105):

> *The influence of climate change on human cultural evolution is regularly assumed but rarely demonstrated. In truth, we have a relatively poor understanding of how individuals, much less groups, respond to long-term environmental change. What we do understand, we understand on relatively short time scales and our limited experience provides us with little ability to suggest how individuals, traditions, or institutions will react or respond to sustained or punctuated environmental change. This situation is due, in part, to the difficulty of collecting and identifying the appropriate data sets with which to track the correlation between environment and culture and to the difficulty of controlling the many interactions that separate a suspected cultural effect from a proposed environmental cause.*

If anything, this insight suggests that the means to better understanding the influence of climate change on human culture lies in data sets which can provide meaningful correlations between environment and culture. Blockley et al. (2006) have stated the possibility for exceptionally rapid climate change to be implicated as a stimulus to human developments has only recently been seriously considered with the publication of the Greenland ice-core records, which show the absolute speed at which the global climate system can change, though earlier palaeoentomological work (e.g.(Atkinson, et al. 1987)) also focused on rapid climate change in the past. They and other researchers have suggested that the Pleistocene-Holocene transition is the best period from which to study this causal link, due to the pronounced climatic shifts, which they suggest triggered sudden widespread changes in human culture (e.g. Blackwell and Buck 2003; Blockley, et al. 2006; Blockley, et al. 2000; Terberger and Street 2002). Binford (1968: 323) and Kirch (1980: 108) also discussed the adaptive linkage between cultural systems and environments in the post-Pleistocene, stressing that 'given a changing environment, certain behaviors within the total range of behavioral variation, confer greater adaptedness upon the population'. This level of rapid disappearance and incursion of habitats, as seen in the early Holocene northern temperate zone, was classified as a *revolutionary* change by Thoday (1953: 110), which he suggested encouraged the strongest selective pressures and behavioral variability.

Halstead and O'Shea (1989: 1) have noted the importance of analyzing cultural responses to resource variability when considering a range of ethnographically-observed cultural phenomena. Yet, they acknowledged the debates which center around interpretations of these phenomena being based, *ad hoc*, on a particular cultural or environmental factor. They have defined the term *buffering mechanism* to describe practices which are intended to dampen the effects of variability. In organizing the wide range of possible buffering mechanisms, they have outlined four basic categories: mobility, diversification, physical storage and exchange (Halstead and O'Shea 1989: 3; Wiessner 1977; see also Wiessner 1982). While several of these categories are applicable to the complex hunter-gatherers discussed in this thesis, such as the storage of deciduous tree nuts (e.g. Rowley-Conwy and Zvelebil 1989), they do not consider the intensification of hunting methodologies by way of technological innovation. Before Halstead and O'Shea's discussion of buffering mechanisms, Wiessner (1977; 1982) outlined hunter-gatherer coping strategies for risk, which included the prevention of loss. Wiessner specifically mentioned the application of 'prevention of loss' occurring over both short and long time periods and included changes in hunting weapons as a key strategy. Hayden (2009) added additional categories in his discussion of risk-reducing strategies, including the development of risk-reducing technologies and Wiessner (1982) also discussed improved subsistence procurement and extraction technologies as means to reduce risk. Unsurprisingly, these types of strategies are commonly seen among dog-assisted hunters in the ethnographic literature (see Chapter 7).

In this sense, I propose the use of hunting dogs as an additional buffering mechanism/'prevention of loss'; a practice employed to counteract scarcity and lessen the impact of variability. The warming climate in the northern latitudes introduced not only new vegetation and faunal species, but also an unpredictable seasonal variability factor when paired with sedentism, which was dramatically different from the high-mobility strategy of hunter-gatherers in the preceding boreal forest. The high-latitude temperate zone is categorized by strong seasonal variability, low species diversity, and unpredictable and extreme fluctuations in population densities. The use of hunting dogs in a seasonal, highly-variable environment, such as a dense temperate deciduous forest, would have proved a valuable buffering mechanism. It is important to note that like the bow and arrow, hunting dogs served as both a long-term adaptation and a short-term buffering mechanism. Rowley-Conwy and Zvelebil (1989) discussed resource fluctuation in high-latitude temperate zones, which included 1) seasonal variation within one year, 2) interannual variation between years, 3) long term variation over a generation or more. While the use of hunting dogs (and the bow and arrow) was certainly a long-term adaptation designed to adjust to new hunting environments and prey species in a general sense, they also served an important role in the buffering of risk during seasonal and interannual variation when maximizing returns within unpredictable environments were essential to survival in the annual and interannual cycle. The prospect that dogs were used beginning in the early Holocene, and throughout the hunter-gatherer period, as an important coping mechanism to both the initial climatic and environmental change that took place after the Pleistocene-Holocene transition, as well as the recurring seasonal variability of the temperate deciduous forest, is further supported by the decline of their burials with the advent of agricultural subsistence and the end of a hunting-based lifestyle.

While many researchers have noted that discussions have primarily focused on social, rather than technological responses to risk, there have been numerous arguments made for understanding human technological behaviors as a means to managing risk (e.g. Bamforth and Bleed 1997; Bousman 1993; Torrence 1989; 2001), though these discussions are always centered around technology as material culture, such as flaked stone tools (e.g. Kuhn 2004; Torrence 1989). Specifically, Torrence (1983), following Oswalt (1976), defined four distinct classes of tools: instruments, weapons, tended facilities, and untended facilities, none of which included a categorization useful for hunting dogs, based on their definitions. In this way, hunting dogs have rarely factored into the conversation about technological adaptations to risk, outside of the ethnographic literature (e.g. Ngima 2006; see Chapter 7). It is important to emphasize that lines of reasoning based on material culture technology, such as projectile points, can also be applied to hunting dogs as technological weapons. Bousman (1993) has stressed that technology can play a significant role in hunter-gatherer economic choices, and that understanding hunter-gatherer foraging requires integrating the benefits of technology, which Torrence (1989: 58-59) has noted are often used to manipulate environments. Myers (1989) reasoned that the shift from the use of simple stone, bone, and antler points in the Palaeolithic, to complex, standardized stone barbs and microliths in the Mesolithic, mirrored the change in prey species from predictable large, migrating herds to smaller, erratic temperate woodland species. He suggested that this technological change improved weapon function and accuracy, which was essential given the unpredictable movements of temperate forest prey, and thus amplified the importance of making a successful kill when prey was found. Interestingly, these are the same benefits noted when using hunting dogs, as documented in the ethnographic literature (see Chapter 7). Torrence (1983; 1989) has demonstrated that hunter-gatherer resource procurement tools vary by latitude, noting that subsistence risk increases with latitude, further supporting the proposal that dogs were a technological adaptation to a dense forest hunting strategy, specifically in the seasonal northern temperate zone.

Theoretical discussions of risk, uncertainty and adaptation, specifically in response to significant climate change, are well documented in the archaeological literature (e.g. Halstead and O'Shea 1989; Rowley-Conwy and Zvelebil 1989; Smith 1988; Tainter and Tainter 1996; Winterhalder and Kennett 2009; Winterhalder, et al. 1999; Winterhalder and Smith 2000), so I will not repeat those arguments here. O'Connell (1995) has contended that archaeology needs to apply an evolutionary theory of behavior in order to better understand subsistence adaptation, which other researchers (e.g. Winterhalder, et al. 1999) have echoed. This is perhaps best summed up by Smith (1988: 223) when he stated:

There are several phenomena, widespread among hunter-gatherers and of considerable anthropological interest, that cannot be fully understood without involving risk, uncertainty and strategic interaction.

After Winterhalder et al. (1999: 302-303), the following terms and definitions are used for subsistence economy in early Holocene hunter-gatherers:

(a) *risk*: unpredictable variation in the outcome of a behavior, with consequences for an organism's fitness or utility.
(b) *uncertainty*: incomplete knowledge of outcome probabilities (see also Knight 1921)

(c) *hazard*: potential sources of harm to an organism

When applied to the complex hunter-gatherers of the northern temperate zone during the Pleistocene-Holocene transition, risk is associated with the decision to either follow the familiar boreal forests and associated fauna north with the retreat of glaciation, increased warming, and an influx of deciduous forests, or to stay in the temperate regions and adapt to the arrival of new flora and fauna, which may have positive or negative impacts on overall subsistence procurement. Winterhalder et al. (1999) have stressed that individuals and systems tend to adapt in order to minimize the problematic dietary shortfalls associated with risk. In the early stages of adaptation to the new Holocene environment and associated prey fauna, hunter-gatherers would have dealt with a high level of uncertainty, due to the adjustments associated with adapting new closed forest hunting methodologies, which may have declined over time as their knowledge of the new environment increased (e.g. Stephens 1987; 1989). In addition, once dense forest hunting strategies were established, seasonal fluctuations in resources would have proved challenging. Rowley-Conwy and Zvelebil (1989: 41) have discussed the pronounced seasonality of the deciduous forest in the northern temperate zone in regards to forager resources, highlighting the effects of fluctuating solar radiation and disparities in seasonal abundance. Myers (1989: 84) also suggested that the shift from the larger, slower herd animals of the Late Pleistocene to the smaller, quicker and more solitary animals of the dense temperate forests ‘introduce(d) risk through the capacity of the resource to avoid detection and capture'. In turn, the hazard relates to the possibility that there are inadequate resources available to provide for the population. Attempts to avoid such hazards can be made through performing risk averse behaviors, such as avoiding unpredictable results in favor of more certain ones (Winterhalder, et al. 1999: 303). Strategies for minimizing risk, such as sharing, resource pooling, cooperative hunting, storage, and magic, are all commonly presented, yet like the shift to microliths and the bow and arrow, the utilization of hunting dogs should be viewed as a significant technological advancement with important risk-averse outcomes. In the case of the hunter-gatherer groups discussed in this thesis, one of the most risk-reducing, hazard-avoidant behaviors would have been the adaptation of hunting dogs as kill-maximizing tools, as observed in dense forest hunting groups throughout the ethnographic literature (see Chapter 7).

Dogs as Weapons

Though ethnographic and modern accounts of the use of hunting dogs to maximize hunting returns leave no doubt that dogs are a useful, and often indispensable hunting weapon, the probability that they were being used by early Holocene hunters in the northern temperate zone specifically as a risk-reducing buffering mechanism has hardly been discussed, and is more difficult to illustrate. It has long been postulated that dogs were used by prehistoric foragers to assist in hunting, with some researchers even suggesting hunting was the impetus for their domestication (Clutton-Brock 1984; Clutton-Brock and Grigson 1983). Among their most practical prehistoric uses, hunting also ranks as one of the most logical possibilities among researchers (e.g. Manwell and Baker 1984; Morey 2010; Munt and Meiklejohn 2007), but discussion of their specific potential contribution and importance to prehistoric hunting strategies is rarely, if ever, elaborated upon. It is often suggested that dogs may have been an 'accessory' to the true weapons, be it bow and arrow, atlatl or thrusting spear, but I propose, as seen in ethnographic hunting records, that when dogs were used by prehistoric hunters, they were actually the primary hunting weapons, with the wood, stone, or bone technology being the secondary or incidental 'accessory', only delivering the final kill. Dogs are used by modern groups, as they probably were by prehistoric groups, during all phases of hunting. They are sent out to look for scent trails of prey before a hunt, to corral and tree prey, hold dangerous prey at bay, track blood trails of wounded animals, to ambush animals, to push prey towards waiting human hunters, to make the final kill, and to carry dispatched prey back to camps. Halstead and O'Shea's (1989: 6) comment regarding buffering mechanisms and mitigating variability is quite applicable to the role of dogs as weapons in some hunter-gatherer groups:

> *…some practices and institutions serve, literally, a vital role in mitigating the effect of variability and some of these buffering mechanisms occupy a central position in human behavior and in the articulation of human communities.*

To effectively analyze the potential of the dog's role as a hunting weapon in prehistoric groups, their qualities must be evaluated as more traditional weapons, such as projectile points, have been. Though this has yet to be done for prehistoric dogs, there is some discussion of dogs as hunting 'weapons' or 'tools' within the ethnographic literature (see Chapter 7). In his ethnography of Bakola hunters in Cameroon, Ngima (2006) classified dogs as hunting tools, along with more traditional tools like nets, spears and snares. His description of hunting dogs in Bakola life has highlighted the potential scope of their value, with a range of variability that far exceeds that of any traditional weapon. He describes dogs as ‘a hunting “weapon” which the Bakola can not spare’ (Ngima 2006: 63). Ngima’s ethnography also demonstrates the wide range of abilities of hunting dogs, including (a) tracking animals in the forest, (b) holding larger animals at bay while the hunter spears it, and (c) capturing smaller animals alone, without human assistance (Ngima 2006: 53). Interestingly, he also notes the socio-cultural effects hunting dogs have within the community, including (a) the warding off of evil spirits, (b) allowing hunters to hunt alone, thus freeing up individuals for other tasks, and (c) providing meat, which then allows the Bakola to facilitate trade and exchange. Ngima stressed that unlike other tools, hunting dogs are ‘related to the entire life of this small-scale society’ (2006: 64). Blackburn (1982) has echoed this critical role of hunting dogs as weapons in his discussion of the Okiek of Kenya, in which he states forest hunting is feasible only because they have dogs, which are critical in bringing animals to bay and within killing range of hunters in dense forests. He emphasizes the importance of dogs, specifically in hunter-gatherer forest societies, noting the Okiek obtain their hunting dogs from the agro-pastoral Maasi, who have little use for them (Blackburn 1982: 293). While drawing direct correlations between ethnographic material and prehistoric activities can be problematic, the range of functions of the dog as a hunting weapon in hunter-gatherer societies, highlighted repeatedly in ethnographic literature from all over the world (see Chapter 7), suggests their aptitude as a hunting weapon is more of an innate, biological characteristic than a chance cultural occurrence, supporting their possible parallel use by hunter-gatherers in early Holocene forests worldwide.

Thus far, the discussion of dogs as early Holocene forest hunting weapons has lacked substance beyond a passing mention. Kennedy (1980) has noted that microliths, bows and hunting dogs were likely critical factors in the hunting of large game in the Mesolithic, and Hayden (1975: 12) has stated, ‘If one decides to hunt with a dog the strategy adopted will be suited to hunting with the dog’. Beyond such ephemeral remarks, dogs are rarely considered as important, risk-minimizing hunting tools in discussions of early Holocene hunting practices (e.g. Churchill 1993; Mithen 1990). Thus, to consider them critically, they must be evaluated on the same basis as other hunting tools. Bleed (1986) suggested that hunter-gatherer tools could be analyzed based on their level of efficiency, for which he outlined four criteria: quicker production time, increased use life, increased effectiveness, and increased production volume.

(1) Quicker production time

The ‘production time’ in training a hunting dog is highly variable, as documented through modern and ethnographic records (e.g. Smith 2002; Stewart, et al. 2012; see Chapter 7). Many hunter-gatherer groups provide very little training for their dogs, instead depending on a combination of innate reflexes and imitation of other experienced hunting dogs in the group (e.g. Lupo 2011b). Other hunters, specifically those who hunt for sport or pest species eradication, have dogs which are highly-trained for specific prey or hunting techniques (Caley and Ottley 1995; Stewart, et al. 2012; Ward 1999; White, et al. 2003). Certainly, the ethnographic records suggest many subsistence hunter-gatherers do not specifically train their dogs (see Chapter 7), yet given this range of 'production time', this criterion would be difficult to evaluate for prehistoric hunter-gatherers. Following the ethnographic and modern data from both subsistence and sport hunters, it can be assumed that most dogs are useful as hunting weapons by between 1-2 years of age, with a varying amount of energy put into their training, ranging from very little by subsistence hunters to a great deal by sport hunters (e.g. Hayden 1975; Pickering 1992; Smith 2002; Terlep 2002; White 1972)

(2) Increased use life

The 'use life' of a dog would be equivalent to the amount of time which it can be used, as traditional material tools, as an effective hunting weapon. On average, modern dogs are weaned by the age of eight weeks (Henley 1966), with training of sporting dogs beginning between six months and one year old, with full training complete between one and two years, and effective hunting lasting on average until between seven and ten years of age (Smith 2002; Stewart, et al. 2012). While there may be reason to believe, with advanced veterinary medicine, modern dogs would live longer than prehistoric ones, dogs from many of the isolated burial sites have been described as 'old' or 'very old' individuals, included one that was aged to over 12 years (e.g. Dowd and Breitburg 1989; McMillan 1970; Nishino and Okazaki 1971; Parmalee 1959; Parmalee, et al. 1972). Following this modern data, and apart from unaccounted death, injury or illness, it can be proposed that prehistoric dogs would have been used as hunting weapons for between 5-9 years of their lives. Bousman (2005; following Gould 1980; Lee 1979; Osgood 1940) has provided the mean use-life of tools for some modern hunting groups, including the Ingalik (1.4 ± 0.3 years), the !Kung (4.2 ± 3.2 years), and Ngatatjara (Western Desert Aborigines; 2.4 ± 3.4 years). Given these use-lives for more traditional tools, the 'use life' of a hunting dog is significantly longer.

(3) Increased effectiveness

One of the primary uses of hunting weapons is to overcome the biological shortfalls humans possess when it comes to predatory adaptations (e.g. lacking claws, large fangs, great speed, or superior senses; Churchill 1993). In general, weapons increase prey size range, and projectile weapons can reduce difficulties associated with quick prey and/or dense vegetation, as experienced by early Holocene temperate forest hunters (Binford 1984). Hunting techniques involving the use of dogs, including treeing, chase/pursuit, disadvantaging (e.g. with the use of thrusting spears), and drives, have all been linked to increased effectiveness in taking forest prey. While it has been suggested that the bow and arrow appeared in the early Holocene as a response to increasing hunting and population pressures (Bergman 1993; Bergman, et al. 1988), hunting with a bow and arrow alone requires 'a well-placed, surgical shot…into the animal to cause it to lie down or drop within a reasonable distance' (Churchill 1993: 18). This method is particularly difficult with medium-to-large prey (such as deer and boar), as evidenced from a large number of healed arrow wounds from Mesolithic sites (Noe-Nygaard 1974). The most effective way of mitigating a kill loss in the case of a misplaced shot is to use a dog to track wounded prey, which results in exceptionally high prey recovery rates (Campo and Spencer 1991; Morton, et al. 1995), and is mandatory for modern hunters in Norway (Olaussen and Mysterud 2012). Hunting dogs are also particularly effective in dense forest hunting, as their superhuman sensory perception allows them to overcome the obstacles of the thick deciduous understory. Indeed, Bergman et al. (1988) have suggested that efficient hunting in post-glacial Europe would have required a weapon effective in the dense vegetation, specifically domestic dogs. Jonsson (1988) has suggested some species of prey animals, specifically wild boar, were preferred by Mesolithic hunters, making methods to more effectively hunt them particularly useful. Magnell (2005) has noted particularly high percentages of wild boar from a few Mesolithic Ertebølle sites in southern Scandinavia, in comparison to other nearby sites. Interestingly, these sites also contain isolated dog burials, suggesting dogs may have been utilized by local populations to more effectively hunt the dangerous, but preferred, wild boar (Jonsson 1985; Larsson 1994; Larsson 1985).

(4) Increased production volume

In reference to more traditional weapons, increased production volume means the ability to produce more tools (projectile points, for example) per unit of raw material. This criteria cannot necessarily be applied to hunting dogs, except, perhaps, in the sense of reproductive value in creating successive generations of hunting dogs, and thus acting as a continuously renewable hunting weapon resource. In this sense, once a foundational domestic dog breeding population was established (notably, one of the traits Hayden (1996) argues for complex societies) the supply of hunting dogs would be continuous.

Koster (2008; 2009) has discussed the application of the optimal foraging and cost-benefit models to the use of hunting dogs for modern subsistence hunters in the forests of Nicaragua. He stated that the use of hunting dogs affected both the encounter rates and pursuit times, but noted there is 'little quantitative evidence on the ways in which the use of dogs affects the parameters of the prey choice model' (Koster 2008: 935). His decision-making model of hunters with dogs (Fig. 8.1) and cost-benefit model for hunting with dogs (Fig. 8.2) provide a useful outline for similar models which may be applied to hunting methodologies involving prehistoric dogs. Echoing his statement that anthropological research on the dog's involvement in the prey choice model has been lacking (Koster 2008: 935), the discussion of the dog as part of a prehistoric prey choice model has been non-existent, even though the ethnographic record makes it clear that dogs are a significant factor in forest hunting strategies (see Chapter 7). The traditional archaeological encounter-contingent prey choice model (Bettinger 1991; 2009; Charnov and Orians 2006) often describes human hunters as the active agents making prey decision choices, yet Koster and many other researchers have documented the extent to which human hunter pursuit and kill decisions are the direct result of dog-determined prey choices (e.g. Ikeya 1994; Kent 1993; Koster 2008; Lupo 2011a; Mitchell 2008; Takeda 1996; White 1972; Yasouka 2006) . These results include not only the type of prey taken, but the age, sex, and other zooarchaeological attributes which are often widely discussed when examining hunter-gatherer subsistence. This has dramatic implications for the interpretation of faunal remains, subsistence and hunting models from dog-containing prehistoric groups, which have gone completely unstudied.

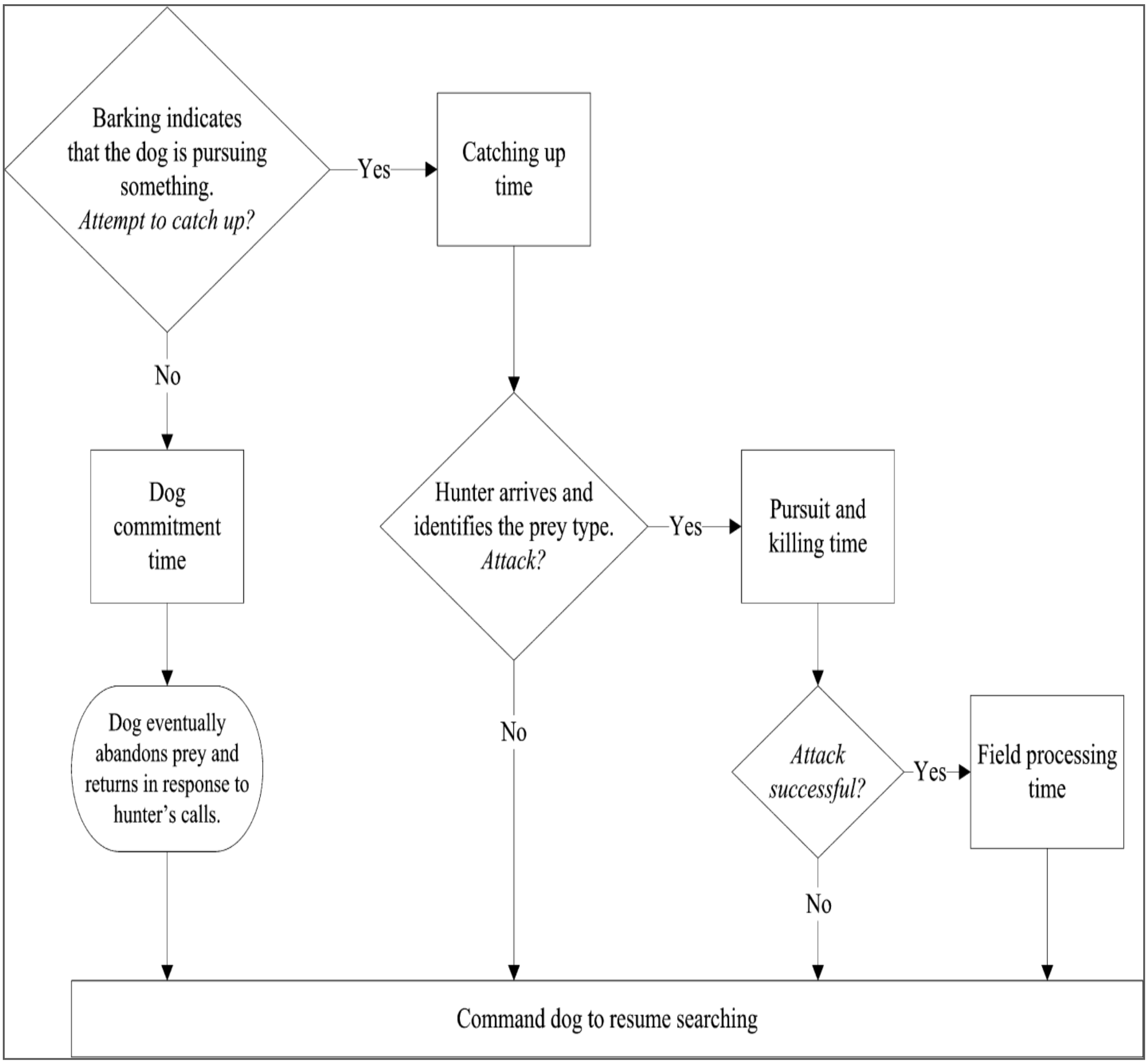


Figure 8.1. Decision-making model of hunters with dogs (Koster 2008)

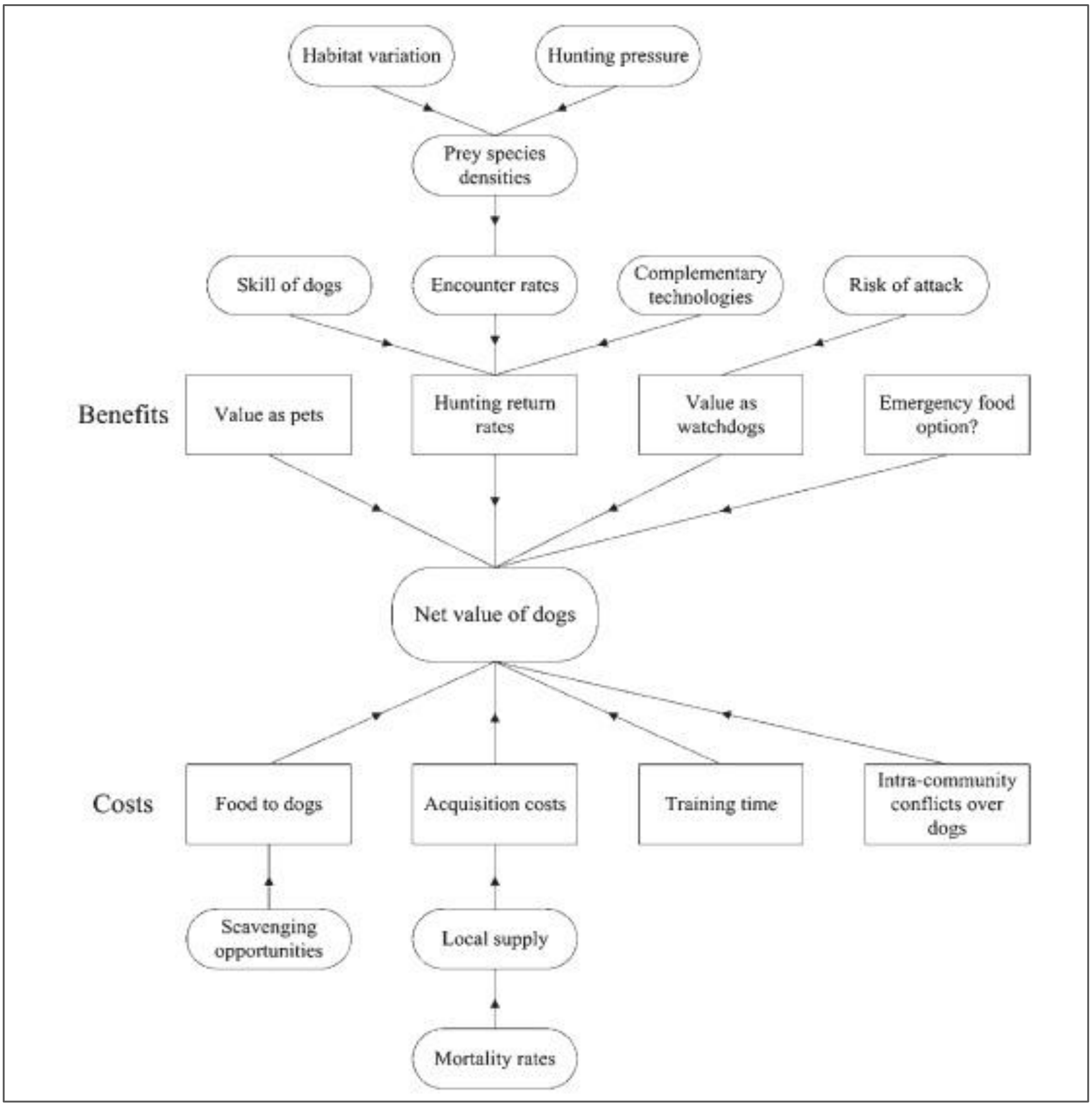


Figure 8.2. Cost-benefit model for hunting with dogs (Koster 2009)

Patterns and Comparisons

Throughout this thesis a case has been made for the identification and analysis of patterns observed in global archaeological data sets. An argument for the use of comparative methods in investigating processes of cultural variation and change has been made by numerous researchers (e.g. Drennan and Peterson 2011; Grunberg 1996; Lawrence 2012; McGuire 2012; Peregrine 2004; Sikora 2003; Smith 2009; Smith 2012; Smith, et al. 2012). This thesis aims to highlight not only the parallels between the isolated dog burial phenomenon in prehistory, but to emphasize the usefulness of cross-cultural comparisons of data sets, specifically on a global scale. In his discussion of cross-cultural approaches in archaeology, Peregrine (2004: 285-286) described three types of cross-cultural comparisons:

(a) *comparative ethnology*, the comparison of ethnographically known cultures or cultural features

Peregrine (2004; 281-282) argued that comparative ethnography was defined as 'the statistical evaluation of theories or hypotheses using data from large (often worldwide) and clearly defined samples of cultures' (see also Ember and Ember 2001). Importantly, he noted that if similarities can be found between worldwide culture samples, there is a strong indication that the 'association fits human behavior in general and not just the customs of a particular culture' (Peregrine 2004: 286; Sanderson 1990). He also suggested that if these similarities are seen in ethnographic cultures, there was no reason the generalization would not apply to prehistoric cultures as well. Given this, the comparison of the usefulness and value of hunting dogs among ethnographic hunting groups due to their innate hunting abilities, for which a strong argument has been made (see Chapter 7), can be used to make a robust case for their analogous use and value among prehistoric hunter-gatherer groups.

(b) *comparative archaeology*, the comparison of archaeologically known cultures or cultural features

Peregrine (2004: 286) identified two approaches in the use of traditional comparative archaeology, which has long been in practice. First is the comparison of societal 'attributes', such as houses or ceramics. Second is the comparison of societal 'types', such as chiefdoms or states. This thesis has applied both these approaches in identifying and comparing the individual isolated burials from each site ('attribute'), as well as comparing the greater complex hunter-gatherer society ('type') in which this phenomenon operates (see Chapter 2). In reference to comparative archaeology, Peregrine has emphasized the importance of global comparative studies, stating 'the main focus is often on identifying a single or group of similar processes that led to the same result in many areas of the world' which has 'produced innovative studies of cultural evolution in an explicitly comparative framework' (2004: 292).

(c) *archaeoethnology*, the comparison of archaeologically known cultures or cultural features in a diachronic mode

Peregrine (2004: 295) has encouraged 'broadly generalizable diachronic comparisons using the archaeological record', which has been hindered by a lack of large, well-defined archaeological samples suitable for comparison. He has stressed that though archaeoethnology is a new field with few published results, it appears to be the most promising in application to future research. Patterns recognized between contemporaneous prehistoric groups can be compared to similar patterns identified in the ethnographic record to make strong inferences about general 'attribute' and 'type' trends in the archaeological record. This methodology was supported by Price (2001: 415) when he stated, '… direct observation of the function and behavior of material culture in the hands of active, living peoples has provided a powerful means of searching for patterns in the past'. This approach does not attempt to make direct associations between patterns of behavior in the past and those observed in the present, but seeks to use the ethnographic record as a tool to inform interpretations of the past. The aim of this thesis has been to do just that.

Peregrine (2004: 303) asserted that '… there are cross-cultural approaches in archaeology that can provide generalizable results, and their use should be encouraged'. This research has utilized each of the three approaches described by Peregrine (2004). A comparative ethnological approach was utilized in evaluating the role of dogs in modern and ethnographic subsistence hunting groups, which found that dogs are often a critical hunting weapon, specifically in the taking of ungulate prey in densely forested environments (see Chapter 7). A comparative archaeological approach was used in evaluating the parallels between palaeoenvironments, socio-economic behaviors, and cultural evolutionary change across the Pleistocene-Holocene transition, and advent of agricultural subsistence, in the three early Holocene complex hunter-gatherer groups. Finally, an archaeoethnological approach was used to explore how the observed ethnographic data could elucidate the patterns detected in the archaeological material. It is proposed that as a generalization observed in many ethnographic groups, the dog is a useful and valuable dense forest hunting tool, which is often revered and afforded a deliberate burial upon death due to its elevated social role as a human-like hunter. Using an archaeoethnological line of reasoning, the similar mortuary treatment of prehistoric dogs in hunter-gatherer groups, together with parallels in palaeoenvironments and socio-economic organization, suggests the impetus for this phenomenon is apt to be the significance of a dog as a hunting weapon, and thus group member.

While patterns for comparison have been identified throughout this study, perhaps the strongest observable pattern is that which is formed with an overall aggregated view of the data sets for each of the three regions discussed (Fig. 8.3). Due to interregional and global variation in the dating and reporting of the material, some burials are associated with exact radiocarbon dates, while others are dated only within a chronological range or cultural period. This makes their comparative representation challenging. In an effort to accurately represent all of the burials on an analogous chronological scale, they have been aggregated into their respective cultural-temporal periods, as defined in each regional chapter (see Chapters 4-6). The American burials have been sorted into Early Archaic, Middle Archaic, Late Archaic and Early Woodland, with Early Woodland burials being those associated specifically with hunter-gatherer sites, though agriculture was beginning to be practiced in the region. Due to the lower number of burials in northern Europe, the shorter time span of their presence, and their more precise dating, they have been grouped temporally between 8,000-7,500 cal B.P., 7,500-7,000 cal B.P., 7,000-6,500 cal B.P., and 6,500-6,000 cal B.P. Like the burials from the United States, the Japanese burials have been categorized into the Initial Jomon, Early Jomon, Middle Jomon, Late Jomon, and Final Jomon. In order to account for some burials which are imprecisely dated across multiple phases (such as Early-Middle Archaic or Initial-Final Jomon), data has been illustrated for both the defined period (data which belongs within that period only; dark colored shading, Fig. 8.3) and the amalgamated period (data which spans multiple periods; light colored shading, Fig. 8.3). In all three regions isolated dog burials started in small numbers and then increased throughout the early Holocene. This pattern is most clear in the American and Japanese data sets, as the lag in the advent of agriculture in these regions saw the phenomenon of isolated dog burials last a significantly longer period of time than is seen in northern Europe. In northern Europe isolated dog burials are excavated from fewer sites and in smaller numbers, but a minor increase in burials is apparent in this data as well. As previously discussed (see Chapter 5), it is possible that additional earlier isolated burials in northern Europe have been obscured by rising sea levels along the Baltic coastlines, particularly in Denmark. Additionally, between the rising sea levels and the taking up of agricultural subsistence around 6,000 cal B.P. in northern Europe, there is shorter time period for the discovery of the coastal hunter-gatherer sites with which isolated dog burials appear to be associated. Importantly, Figure 8.3 illustrates the strong association between isolated dog burials, environments and subsistence. It makes clear that the termination of isolated dog burials is not temporal, but instead is related to the beginning of agricultural subsistence in each region.

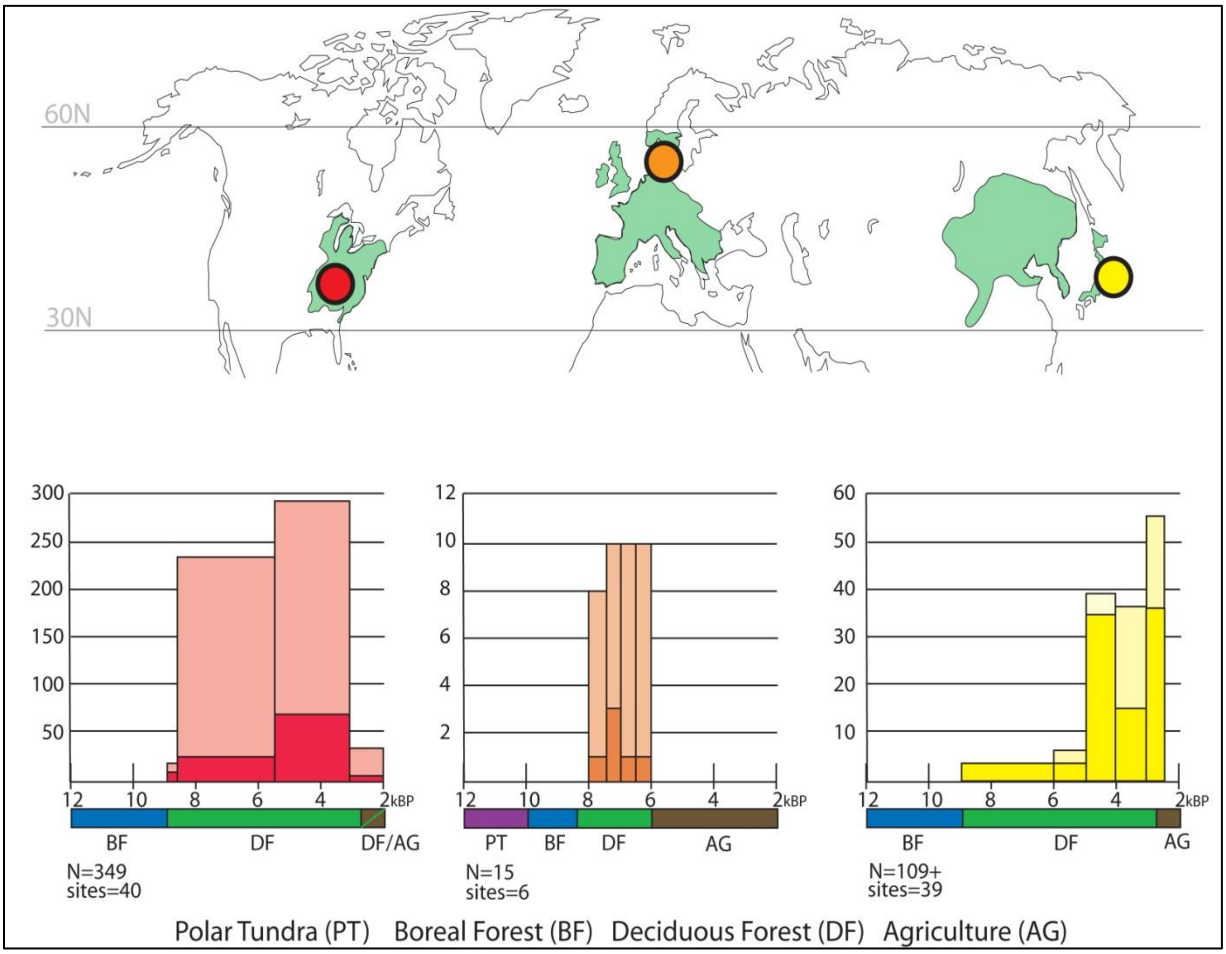


Figure 8.3. Number of individual early Holocene isolated dog burials in the midsouth United States, northern Europe, and eastern Japan between 12,000-2,000 years ago with associated climatic environments and subsistence practices. Green areas on map indicate the maximum extent of the temperate deciduous forest during the early Holocene. Bars on each chart indicate the different chronological periods in which isolated dog burials are found, with the darker part representing burials from the defined period and lighter parts representing additional amalgamated burials which are dated across multiple periods.

Considerations

One of the most curious anomalies in the entire data set is the isolated burial of puppies, as has been identified in all three of the regions (see Appendix 4). Given the age of a useful hunting dog is considered to begin around 1- 2 years old (see Chapter 7), it seems unlikely that the puppies afforded isolated burials, especially in the case of a fetus or newborn (Kaneko 1977), would have served any functional hunting purpose. Again, the ethnographic record provides insight into possible explanations. It has demonstrated that puppies in hunter-gatherer groups are often valued for their *potential* as a future hunting partner and group member (e.g. Clutton-Brock 1995; Koster 2008; Nobayashi 2006; Terashima 1983; White 1972), and are frequently given personal names which 'individualize' them (Bennett 1962; Caneiro 1988; Koster 2007; 2009; Yde 1965). This acknowledgment of puppies as prospective hunting partners that should be well cared for and treated with an almost human-like status (which, interestingly, they have not yet ‘earned’) seems well-documented from modern hunter-gatherer groups. Koster (2008; 2009) has noted that the puppies of subsistence hunters in Nicaragua are sometimes given specially-purchased cow’s milk or human breast milk, and White (1972: 202) stated that at an Australian Aboriginal camp there was special attention shown to puppies which were ‘recognized from birth as being potential hunting dogs’. Victor and Robert-Lamblin (1993: 339) noted that when puppies were about to be born or a puppy was stillborn, Eskimo in Greenland ‘left the house just as they would have done in the case of a human being’. Laugrand and Oosten (2002: 92) documented that the Inuit of the Canadian Arctic believed ‘… when pups were born, their characters were also made’ and ‘people took great care to bring up puppies in such a way that they would become useful members of society’. From the same cultural group, Rasmussen (1931: 150) has recorded that deceased puppies were sometimes buried under stones, as several of the prehistoric dogs had been (Bentz 1988; Griffin, et al. 1974; McMillan 1970; Otake 1983). These ethnographic accounts show that some hunter-gatherer groups anthropomorphize prospective future hunting dogs, acknowledging their potentially important role in the group in the future. Such ethnographic description has previously led Clutton-Brock (1995) to suggest that in the prehistoric period puppies were also reared for their potential as successful hunting partners.

In modern, industrial populations the mortality rates of puppies are fairly low, with the death rate in dogs not increasing until after about 7 years old (e.g. Egenvall, et al. 2000). Though puppies were often ritually sacrificed in the historic period (e.g. Arax 1995; Bowie 2002; Collins 1990; Mazzorin and Minniti 2006; Wilkens 2002), the lack of dispatch trauma to these prehistoric remains, and evidence for high puppy mortality, due primarily to malnutrition and predators, in ethnographic hunter-gatherer groups suggests the puppies found in isolated burials were not intentionally killed (e.g. Fiorello, et al. 2006; Koster 2008; Koster 2009; Smole 1976; Yu 1997). Consequently, the isolated burial of puppies in largely transegalitarian forager groups presents a conundrum. Fahlander (2008: 36) has discussed the ambiguous identity of children in hunter-gatherer groups, suggesting ‘children and juveniles seldom are the great producers, leaders or innovators in prehistoric societies’, leaving their social position (and often their burial) somewhat liminal. Indeed, this fits with the premise that transegalitarian societies include social positions which are determined by personal accomplishments while living, and are not ascribed from birth (Bader and Granger 1989; Lynch 1982; Stafford, et al. 2000; Walthall 1998). Yet, if it is assumed human infants and young children are buried primarily due to their core identity as a human, which infers some level of recognition, however liminal, why are puppies buried? Interestingly, this seems to suggest two things: (1) in some groups which use dogs as important hunting tools, puppies are assigned a personified role from birth, and (2) the burial of puppies transcends the transegalitarian nature of some groups, allowing them some level of ascribed status based on their potential social/functional role.

Discussion of the identity of the dogs afforded isolated burials also begs the question of why some dogs were buried and others were not. At every site from which isolated burials were excavated there are other types of dog remains present as well. At the site of Apple Creek in the United States there were seven isolated dog burials, but there were also miscellaneous dog remains scattered around the site, some with evidence for butchery, suggesting some dogs may have been eaten as well (Parmalee, et al. 1972). At the Skateholm site in southern Sweden there were seven isolated burials of dogs, but there were also associated burials of dogs with humans, inclusion of dog elements with human remains, and scattered dog bones found throughout the site (Larsson 1994). This pattern of multiple mortuary treatments of dogs is demonstrated throughout the entire survey. Numerous ethnographies have noted that good hunting dogs receive better care than their less-capable counterparts (Crocker 1977; Heinen 1972; Koster 2007; McSweeney 2003; Sponsel 1981). Nobayashi (2006) discussed the role of different dogs among modern subsistence hunter in Taiwan, stating that the value of dogs to hunters was based on their specific abilities, with fearless, aggressive boar hunting dogs being among the most prized. Their villages also had some dogs which were useless for hunting and thus not given much thought or attention. It was only the prized hunting dogs which were provided a proper burial. It is likely that similar disparities in the roles and values of prehistoric hunting dogs led to the variation in mortuary treatments, with the most revered dogs being afforded isolated burials.

Another consideration for examining the presence of isolated dog burials in the prehistoric record is the matter of their abrupt appearance in multiple locations around the world at nearly the same time. This thesis argues for a link between the appearance of these burials and the rapid shift in environment and socio-cultural changes in the early Holocene northern temperate latitudes. The possibility that this phenomenon appears, nearly simultaneously, in three culturally and geographically unrelated locations by coincidence is highly doubtful. Similarly, the likelihood that the appearance of isolated dog burials is solely the result of more permanent habitation after the Pleistocene-Holocene transition, and thus a higher chance of being discovered, is improbable. Though the ephemeral nature of late Pleistocene habitation sites has been well documented from all three regions (see Chapters 4-6), they are not completely absent from the record. Late Pleistocene sites, including those with human and dog remains, have been uncovered in the United States, northern Europe and Japan, none of which have contained isolated dog burials as seen from the early Holocene period (e.g. Baba and Narasaki 1991; Benecke 1987; Germonpré, et al. 2012; Green, et al. 1998; Kobayashi, et al. 1971; Miller 2007; Napierala and Uerpmann 2012; Sanders 1990; Soday 1954; Steele and Powell 1993; Young, et al. 1987). While late Pleistocene sites are generally fewer in number in comparison to later sites, there are an even smaller number of sites which have stratified habitation between the Pleistocene and Holocene periods. There are some exceptions. The Morris site in the United States has a Palaeoindian layer marked by the presence of projectile points, unifacial scrapers, gravers and knives, but not isolated dog burials. The same site also has a later early Holocene Archaic layer which has three isolated dog burials (Rolingson and Schwartz 1966). The well-documented Dust Cave site in the United States also has stratified layers beginning in the Pleistocene and going through the Archaic period (Sherwood, et al. 2004; Walker 2010; Walker and Morey 2005). Again, like the Morris site, dog burials were only found in the Archaic layers of the site. These sites further support the association of the isolated dog burial phenomenon with aspects of post-Pleistocene adaptations.

Importantly, a number of sites with early Holocene isolated dog burials also have later stratified agricultural components, which lack similar burials (e.g. Bentz 1988; Curren 1981; Faulkner and Graham 1966; Gremillion and Yarnell 1986; Rolingson and Schwartz 1966). The sudden disappearance of isolated dog burials with the advent of agricultural subsistence further strengthens their connection to a hunting-based lifestyle. This concept is perfectly summed up by one of the most prolific excavators of isolated dog burials in the midsouth United States, Haag (1948: 253), when he stated:

> *The apparent fact that the dog lost much of its importance to the aborigines with the advent of agricultural practices may indicate that the dog was primarily used by hunters. It is in the Hunter-Fisher-Gatherer horizons all over the world that the dog is prominent in their cultural context*

Similar statements have been made by Parmalee (1962: 406) in reference to later agricultural periods:

> *…the dog was not a revered animal as was often the case in Archaic and other early cultures*

Smith (1975: 110):

> *An almost total lack of evidence for intentional interment of dogs at Middle Mississippian sites suggests dogs were not held in much esteem in the villages*

Warren (2000: 105):

> *…dog burials decrease in frequency after the Archaic and are rare at the Mississippian*

Funk (2008: 17):

> *…in the agricultural Yayoi period following the Jomon period the descendants of the Jomon dogs lost their meaning as hunting companions as well. There were no more careful burials, presumably dogs for the first time served as food*

A final consideration is the very specific regional location in which each of the clusters of isolated dog burials is found. This thesis has argued one of the critical factors involved in the importance of dogs to a temperate forest hunting strategy is their use as an adaptive tool, a weapon which helps adjust to a particular and specific new hunting environment and prey species. An argument has been made for their particularly important utilization with ungulate species in dense forests, though they are used for hunting in a variety of modern environments as well (see Chapter 7). A documented rapid shift in climate, environment, and prey species at sites with isolated dog burials was likely the driver for intensive use of hunting dogs, while growing resource pressure through the early Holocene, due to sedentism near static resources, may have strengthened the dog's value as a kill-maximizing weapon. Nearby regions which did not share this particular environment or prey species, or did not experience a similarly rapid shift to the ungulate-deciduous forest-aquatic resource ecotone, may not have used dogs as a hunting tool, or may not have buried them in a similar way.

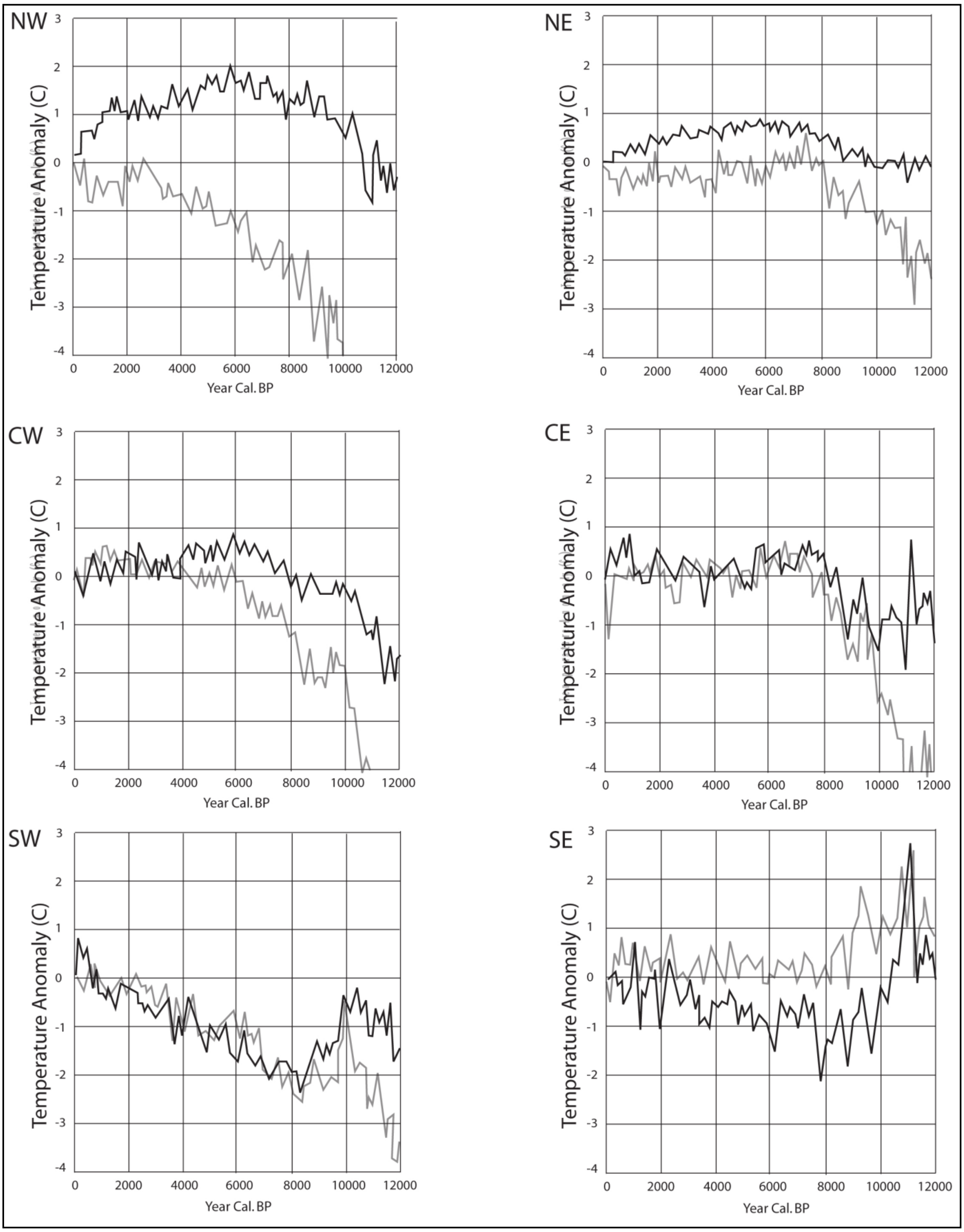


Figure 8.4. Reconstructed area-average summer (dark) and winter (light) temperature anomalies for six regions in Europe during the Holocene (adapted from Davis, et al. 2003)

It is important to note that while the presence of isolated dog burials in these prehistoric deciduous forest hunter-gatherer groups certainly suggests a connection to the use of dogs as an adaptive early Holocene hunting weapon, it is not suggested that all early Holocene hunter-gatherers who were taking ungulate prey in dense forests should be expected to have buried dogs. Certainly not all dog-dependent hunting groups in the ethnographic record bury their dogs (see Chapter 7). Equally, many early Holocene hunter-gatherer groups which are known to have hunted primarily deer and boar, and to have lived in deciduous forests environments, such as those in Britain, Germany, and France, have no current evidence for isolated dog burials during the same period. Some regions of the northern temperate zone saw a much less dramatic shift in climate and environment than was experienced in the midsouth United States, northern Europe, and eastern Japan. The southeastern United States, southern Europe, and southern Japan had already established mild temperatures, deciduous forest communities and associated woodland fauna during the late Pleistocene (Aikens and Akazawa 1996; Aura, et al. 1998; Delcourt and Delcourt 1979; Ellis, et al. 1998; LaMoreaux, et al. 2009; López-García, et al. 2013; Meeks and Anderson 2012; Sato, et al. 2011; Straus 1996a). In contrast to the rapid change seen in northern Europe, Straus (1996a: 83) argued that 'the record of Pleistocene-Holocene transition (in southwest Europe) is one more of *continuity* than of rupture in resources and adaptations'. If the impetus to the intensive use of dogs for hunting was tied to a rapid environmental shift at the Pleistocene-Holocene transition, it can be proposed that dog burials may not be found in the southern regions of the study areas due to a lack of significant change in vegetation and prey species. Similarly, if dogs became increasingly important through the early Holocene due to resource pressure and stress related to sedentary habitation, rising populations and irregular fluctuations in local seasonal resources, the regions in which isolated dog burials are present would be much more prone to seasonal variation. For example, even within nearby areas in the northern temperate zone in Europe, seasonal temperature anomalies in northwest Europe (where all the isolated dog burials are located) are highly divergent from other regions (Fig. 8.4). This indicates that even within the northern temperate zone, some regions were dealing with much more unpredictable seasonality during the early Holocene, which may have led to the differential development of coping strategies focusing on short-term resource maximization in order to prepare for potential seasonal resource failures. Though these variations in environment, faunal communities and seasonality within the northern temperate zone allude to possible reasons for variation in the isolated dog burial record, the disparity may just as easily be explained by unknown cultural factors.

Chapter 9: Conclusion

Introduction

This work has attempted a global cross-comparison of the intentional burial of dogs in early Holocene hunter-gatherer sites from the midsouth United States, northern Europe and eastern Japan. I have demonstrated that the parallels observed in these groups extended beyond the dog burial phenomenon and encompass palaeoenvironments, socio-cultural traits, and cultural evolutionary adaptations. I have argued that the nearly simultaneous appearance of isolated dog burials amongst these culturally and geographically unrelated foragers appears not to be a matter of coincidence, but a specific, global adaptation to rapid early Holocene environmental change. Through a multi-scalar approach, I have examined and compared these three regions using archaeological, palaeoenvironmental, and ethnographic material to characterize the dynamic relationship between post-Pleistocene foragers, their environments, and their use of dogs as dense forest hunting adaptations. This analysis has established a clear chronology of cultural, environmental and subsistence patterns and change over time, including across the Pleistocene-Holocene transition and the advent of agriculture, in each of the regions. This analysis shows not only general parallels between the regions, but that these cultures were adapting to rapid, large-scale change in remarkably similar ways. In this concluding chapter I provide a brief summary of the principal conclusions of this study in relation to the aims set out in Chapter 1 and also suggest some opportunities for future research.

Adaptation

More than anything, this thesis has emphasized the nature of human adaptation in prehistory. It has utilized a cultural phenomenon occurring simultaneously in three regions, the intentional, individual dog burial, to explore the process of adjustment and adaptation to rapid, dramatic climate change by human groups. Towards this effort, the dog has been considered on par with a tool, a technological innovation which has allowed prehistoric human groups to survive and thrive in the face of significant change, both environmental and cultural. A typology was developed to allow for the categorization of variables in mortuary treatment, thus allowing a particular cultural behavior to be isolated and investigated objectively across the global record. Through this framework, similar mortuary treatments of dogs were identified in three culturally and geographically unrelated regions. Next, other comparable variables were analyzed, including palaeoenvironments and socio-cultural traits which might explain the parallel occurrence of isolated dog burials. This allows for the comparative characterization of the groups, which suggested a casual association between the similar environmental and cultural similarities. Finally, the investigation of the use of dogs in similar hunter-gatherer groups in the modern and ethnographic record offered a broadly generalizable diachronic comparison, through an archaeoethnological approach, to ways in which prehistoric hunter-gatherers may have utilized hunting dogs in changing environments. The dog has been many things to man, and for the early Holocene hunter-gatherers of the midsouth United States, northern Europe and eastern Japan it appears it was a tool, a weapon, a valued hunter, a revered individual; an adaptation – neither person, nor beast.

Future Research

This thesis has demonstrated the usefulness of a global cross-comparative analysis of archaeological data sets, yet the ability to provide objective and cross-culturally valid studies relies on the availability of rich data sets. Zooarchaeology, and specifically investigations into the human-animal relationship in prehistory, is valuable in its potential to provide insight into the human past, yet research and interpretation of faunal remains beyond provisionary functions are still lacking. In its unique position as both the first domesticate and that which holds a distinctly liminal position between the human and animal worlds, the dog offers unlimited prospects for understanding multiple facets of prehistoric hunter-gatherer lifeways. Moving forward, understanding the prehistoric past through dogs can be improved by (a) the detailed collection and publication of dog mortuary data, (b) a more integrated use of the ethnographic and modern ecological literature in understanding past functions and behaviors, and (c) consideration of the dog as not only an animal, but a ‘weapon’. Borrowing from recent anthropological work with modern hunter-gatherers, the potential for the building of a framework for understand the dog as a kill-maximizing, risk-minimizing weapon in prehistory is substantial. While archaeology has traditionally focused on more material tools, such as projectile points and spears, in discussing hunting methodologies, investigation of the ‘dog as weapon’ concept (and perhaps other animals, such as horses) has significant implications for hunter-gatherer studies, such as decision-making, prey choice, cost-benefit and optimal foraging models. More generally, there is a need for a more detailed analysis of processes of change and adaptation, especially in regards to dramatic climate change, which can be reliably analyzed and compared on a global scale. While forays into global comparative archaeology often prove challenging, they are necessary in allowing a broad-scale understanding of the nature of the human past.

Appendix 1: Primary Dog Burials in the Midsouth United States

CO	RG	SITE	DATE	#DB	SM	INJ	PP	GG	REF
US	IL	Koster	10110-9700 cal B.P.	3	N, O	N	Y	Y	(Morey and Wiant 1992a; Widga, et al. 2012)
US	IL	Apple Creek	ca. 2500-1000 cal B.P.	7	N, O	N	N	N	(Parmalee, et al. 1972)
US	IL	Modoc	ca. 8000-7650 cal B.P.	2	N, RS	Y	N	N	(Fowler 1959; Parmalee 1959)
US	MO	Rodgers Shelter	ca. 7450 cal B.P.	1	N, RS	N	Y	Y	(McMillan 1970)
US	AL	O'Neal	ca. 8000-3000 cal B.P.	1	Y	N	N	N	(Turner 2006; Webb and DeJarnette 1942)
US	AL	Long Branch	ca. 8000-3000 cal B.P.	3	Y	N	N	N	(Webb and DeJarnette 1942)
US	AL	Mason Island	ca. 5450 cal B.P.	1	Y, I	N	N	N	(Haag 1948; Webb 1939; Worthington 2008)
US	AL	Bluff Creek	Middle-Late Archaic	2	Y				(Claassen 2008; Saunders 1994; Webb and DeJarnette 1942)
US	AL	Russell Cave	ca. 8000 cal B.P.	1	N, C	N	Y	Y	(Griffin, et al. 1974; Miller 1956)
US	AL	Flint River	ca. 5000 cal B.P.	19	Y	N			(Webb 1948b; Worthington 2008)
US	AL	Whitesburg Bridge	ca. 5584-2411 cal B.P.	10	Y				(Claassen 2008; Haag 1948; Webb and DeJarnette 1948c; Webb and Wilder 1951)
US	AL	Little Bear Creek	ca. 5450 cal B.P.	6	Y	N			(Webb and DeJarnette 1948a; Worthington 2008)
US	AL	Perry	ca. 5983-487 cal B.P.	42	Y, I	N	N	N	(Claassen 2010; Webb and DeJarnette 1942; 1948b)
US	AL	Pride (Ct 17)	Late Archaic	1	Y	N	N	N	(Webb 1938)

Appendix 1: Primary Dog Burials in the Midsouth United States

CO	RG	SITE	DATE	#DB	SM	INJ	PP	GG	REF
US	AL	Dust Cave	6500-5600 cal B.P. (B1) 5800 cal B.P. (B2) 8400 cal B.P. (B3) 8400-6000 cal B.P. (B4)	4	N, C	Y	Y	Y	(Morey 1994; Sherwood, et al. 2004; Walker and Morey 2005)
US	AL	Mulberry Creek	ca. 6950 cal B.P.	11	Y	N	N	N	(Webb and DeJarnette 1942; Worthington 2008)
US	KY	Barrett	ca. 6422-5170 cal B.P.	11	Y	N	Y	N	(Herrmann 2002; Webb and Haag 1947)
US	KY	Indian Knoll	ca. 6401-3740 cal B.P.	11	Y, I	N	Y	N	(Herrmann 2002; Morey, et al. 2002; Webb 1946; Winters 1974)
US	KY	Read	ca. 8000-3000 cal B.P.	63	Y, B	N	Y	N	(Milner and Jefferies 1998; Webb 1946; 1950b)
US	KY	Carlson Annis	ca. 8770-2537 cal B.P.	25	Y	N	Y	N	(Arnold and Libby 1951; Marquardt and Watson 1983; 2005; Webb 1950a; Webb and Haag 1947)
US	KY	Chiggerville	ca. 5000 cal B.P.	7	Y	N	N	N	(Webb and Haag 1939; Worthington 2008)
US	KY	Jackson Bluff	ca. 5450 cal B.P.	12	Y, B				(Claassen 2008; Morey 2010; Worthington 2008)
US	KY	Bowles	ca. 4887-2357 cal B.P.	7	Y				(Claassen 2008; Haskins and Herrmann 1996; Marquardt and Watson 1983)
US	KY	Jimtown Hill	ca. 5000-3000 cal B.P.	10	Y, B				(Claassen 2008; Haag 1948)
US	KY	Baker	ca. 5450 cal B.P.	12	Y, B		Y	N	(Claassen 2008; Haag 1948; McBride 2000; Milner, et al. 1986)
CO	RG	SITE	DATE	#DB	SM	INJ	PP	GG	REF

Appendix 1: Primary Dog Burials in the Midsouth United States

US	KY	Butterfield	ca. 5450 cal B.P.	7	Y	N	N	N	(Webb and Haag 1947)
US	KY	Ward	ca. 8594-4806 cal B.P.	16	Y, B	N	N	N	(Herrmann 2002; Meindl, et al. 2001; Pedde and Prufer 2001b; Webb and Haag 1940a)
US	KY	Kirkland	ca. 8235-4196 cal B.P.	10	N, O	N	N	N	(Claassen 1996; Haskins 1988; Webb and Haag 1940a)
US	KY	Morris	ca. 5000-3000 cal B.P.	3	N, O				(Rolingson and Schwartz 1966)
US	TN	Duncan Tract	ca. 3000 cal B.P.	3	Y	N	N	N	(Breitburg 1983)
US	TN	Anderson	ca. 8292-6290 cal B.P.	1	Y	Y	N	N	(Claassen 2010; Dowd and Breitburg 1989; McNutt 2008)
US	TN	Robinson	ca. 3612-2336 cal B.P.	1	Y	Y	N	N	(Claassen 2010; Morse 1967)
US	TN	Phipps Bend	ca. 3300-1400 cal B.P.	2	N, O	N	Y	N	(Curren 1981)
US	TN	Eva	6000-4000 cal B.P.	14	Y	N	Y	Y	(Crane 1956; Dye 1996)
US	TN	Cherry	ca. 3700 cal B.P.	2	Y	N	N	N	(Lewis and Lewis 1947; Magennis 1977; Worthington 2008)
US	TN	Bailey	ca. 5141 cal B.P.	3	Y	N	Y	Y	(Bentz 1988; Worthington 2008)
US	TN	Westmoreland-Barber	ca. 2285 cal B.P.	2	N, O	N	N	N	(Faulkner and Graham 1966; Gremillion and Yarnell 1986)
US	TN	Kays Landing	ca. 5301-1978 cal B.P.	1	Y				(Claassen 2008; 2010; Lewis and Kneberg 1959; McNutt 2008)
US	TN	Big Sandy	Early-Middle Archaic	11	Y				(Claassen 2010)
US	TN	Hayes	ca. 6995-4579 calB.P.	1	Y		Y	N	(Claassen 2008; 2010; Klippel and Morey 1986)

Appendix 2: Isolated Dog Burials in the Northern Europe

CO	RG	SITE	DATE	#DB	SM	INJ	PP	GG	REF
DK	Jutland	Nederst	c. 7th millenium B.P.	2	Y				(Larsson 1990a; Nielsen and Petersen 1993)
DK	Jutland	Ertebølle	c. 7000-6300 calB.P.	1	Y				(Larsson 1990a; Winge 1900)
DK	Zealand	Vedbaek-Gøngehusvej 7	c. 7700-7500 calB.P.	1	N, O				(Brinch Petersen, et al. 1993; Brinch Petersen and Meiklejohn 2003; Nielsen and Petersen 1993)
NL	South Holland	Polderweg	c. 7500-7300 calB.P.	3	N, O				(Kooijmans 1993; 2001; 2003; Van de Noort 2008)
SW	Scania	Skateholm	c. 8000-6000 calB.P.	7	N, O	N	Y	Y	(Larsson 1990a; b; 1994)
SW	Scania	Bredasten	c. 6500-6000 cal B.P.	1	N, O	N	Y	N	(Jonsson 1985; Larsson 1990a; Larsson 1985)
DK	Jutland	Dyrholmen	c. 6680 cal B.P.		N, O				(Degerbøl 1933; Fischer, et al. 2007a; Larsson 1990b; Noe-Nygaard 1988)
DK	Funen	Agernaes	c. 5600-5100 cal B.P.		N, O				(Richter and Noe-Nygaard 2003)
DK	Zealand	Vedbaek-Boldbanner	c. 6510 cal B.P.		N, O				(Aaris-Sørensen 1977; Larsson 1990a; b)
DK	Lolland	Argus Bank	c. 7080-6870 cal B.P.		N, O				(Fischer 1987; Fischer, et al. 2007b)
SW	Scania	Segebro	c. 7400-6900 cal B.P.		N, O				(Lepiksaar 1982; Peterson 2006)
SW	Scania	Sjöholmen	Ertebølle		N, O				(Althin 1954; Dahr 1937; Forssander 1930; Larsson 1990b)

Appendix 3: Primary Dog Burials in Eastern Japan

CO	RG	SITE	DATE	#DB	SM	INJ	PP	GG	REF
JP	CHB	Kasori North	Middle Jomon	2	Y		Y		(Takiguchi 1977)
JP	CHB	Fujiwara Kannondo	Middle Jomon	no info	Y				(Kobayashi, et al. 2004)
JP	CHB	Yahagi	Late Jomon	2	Y				(Center for Cultural Properties 1981)
JP	CHB	Kamishinjuku	“Jomon”	no info	Y				(Shibata 1969)
JP	CHB	Ebigasaku	Middle Jomon	no info	Y				(Shibata 1969)
JP	CHB	Kainohana	Late-Final Jomon	no info	Y				(Yawata and Daigaku 1973)
JP	CHB	Takanekido	Middle Jomon	3	Y	Y			(Nishino and Okazaki 1971)
JP	CHB	Shimoota	Middle Jomon	1	Y		Y		(Sugaya and Toizumi 1998)
JP	CHB	Soya	Middle-Late Jomon	2	Y		Y	Y	(Horikoshi 1977)
JP	CHB	Kasori South	Late Jomon	3	Y		Y		(Takiguchi 1977)
JP	IWT	Nakazawahama	Early-Final Jomon	3	Y				(Sato 1995b)
JP	IWT	Kaitori	Late Jomon	5	Y	Y			(Kusama and Kaneko 1971)
JP	IWT	Monzen	Middle-Late Jomon	no info	Y				(Hasebe 1925a; Matsumoto 1917; Shibata 1969)
JP	IWT	Oohora	Final Jomon	no info	Y				(Esaka 1956; Hasebe 1925b; 1936; Shibata 1969)
JP	IWT	Shimofunato	Late-Final Jomon	1	Y				(Committee of Editorial in Ofunato City 1978)
JP	MYG	Ugasaki	Early Jomon	1	Y	Y			(Oikawa 1980)
JP	MYG	Kawakuda Rihibiki	Middle-Late Jomon	no info	Y				(Matsumoto 1929; Shibata 1969)
JP	MYG	Satohama	Final Jomon	no info	Y				(Okamura 1980; 1986)
JP	MYG	Tagara	Final Jomon	22	Y	Y			(Hirasawa 1986; Shigehara and Hongo 2000)
JP	MYG	Nakasawame	Late-Final Jomon	1	Y				(Sudo 1985)
JP	MYG	Minamizakai	Middle-Final Jomon	some	Y				(Goto 1969)

Appendix 3: Primary Dog Burials in Eastern Japan

CO	RG	SITE	DATE	#DB	SM	INJ	PP	GG	REF
JP	FSH	Terawaki	Late-Final Jomon	1	Y				(Watanabe 1966)
JP	FSH	Ohata	Middle Jomon	27	Y				(Manome 1975)
JP	FSH	Kaminouchi	Middle Jomon	1	Y		Y		(Kashimura 1994)
JP	FSH	Usuiso	Late-Final Jomon	1	Y	Y	Y	Y	(Otake 1983)
JP	FSH	Sanganji	Late Jomon	3	Y	Y	Y		(Mori 1988)
JP	SAT	Ishigami	Late Jomon	1	Y		Y		(Kaneko 1977)
JP	SAT	Hanazumi	Early Jomon	no info	Y				(Shibata 1969)
JP	KAN	Natsushima	Initial Jomon	1	Y				(Shigehara and Hongo 2000)
JP	KAN	Tsutsumi	Late Jomon	1	Y				(Education Board of Chigasaki City 1963)
JP	KAN	Nishinoyato	Early Jomon	1	Y	Y			(Toki 1936)
JP	ACH	Karekinomiya	Final Jomon	1	Y		Y		(Sumiyoshi 1981)
JP	ACH	Ikawazu	Final Jomon	7	Y		Y		(Editorial Committ Report of Ikawazu 1972)
JP	ACH	Yoshigo	Late-Final Jomon	12	Y		Y		(Hasebe 1952a; Saito 1952)
JP	ACH	Motokariya	Late-Final Jomon	no info	Y				(Naora 1972; 1973)
JP	EHM	Kamikuroiwa	Initial Jomon	1	N, RS				(Esaka 1967; Shigehara and Hongo 2000)
JP	NAG	Wanaba	Middle Jomon	no info	N, O				(Educational Board of Hara Village 2010)
JP	SHZ	Nishikaizuka	Late Jomon	no info	Y				(Naora 1965)
JP	IBA	Koyamadai	Final Jomon	5	Y		Y		(Nagamatsu 1976)

Appendix 4: Additional Dog Burial Information

SITE	INJURY	GRAVE GOOD	DOG NOTES	REF
Koster (US)		associated mano and metate	all dogs same size	(Morey and Wiant 1992b; Widga, et al. 2012)
Eva (US)		2 splinter bone awls, large stone pick	very large dog in 'curled' position	(Dye 1996; Lewis and Lewis 1947; 1961)
Perry (US)			dogs buried in 'sleeping' position	(Webb and DeJarnette 1942; 1948b)
Apple Creek (US)			5 mo. old to 'old' in age	(Parmalee, et al. 1972)
Bailey (US)		1 opposum, 1, cottontail, 23 white-tailed deer elements, limestone slab	small beagle-like or terrier dog, advanced age	(Bentz 1988; Worthington 2008)
Russell Cave (US)		Buried in stone slab ‘coffin’ with projectile point	small dog	(Griffin, et al. 1974; Miller 1956)
Duncan Tract (US)			aged from 'puppy' to 'mature'	(Breitburg 1983)
Robinson (US)	worn teeth, arthritis		dog 1: arthritic adult with completely worn teeth, size of husky; dog 2: extremely small and lightly built dog, beagle-sized or smaller	(Claassen 2010; Morse 1967)
Anderson (US)	worn teeth, arthritis, four broken/healed thoracic spinous processes, broken/healed baculum, broken/healed ribs, vertebral lipping, inflamed/infected joints		'very old' dog in semi-flexed position	(Dowd and Breitburg 1989; McNutt 2008)
Rodgers Shelter (US)	worn teeth	tumulus of dolemite rocks, lithic debitage	About the size of a fox terrier, extensive wear on teeth suggests mature adult	(McMillan 1970)

Appendix 4: Additional Dog Burial Information

SITE	INJURY	GRAVE GOOD	DOG NOTES	REF
Dust Cave (US)	spinal curvature (burials 1 and 3)	Benton projectile point (burial 1)	all adults over two years	(Morey 1994; Sherwood, et al. 2004; Walker and Morey 2005)
Modoc (US)	broken/healed humurus (burial 1); worn teeth and infected mandible (burial 2)		both adults	(Fowler 1959; Parmalee 1959)
Mason Island (US)			buried in 'natural sleeping position'	(Haag 1948; Webb 1939)
Skateholm (SW)		flint flakes, red deer antler, ornamental antler hammer, red ochre		(Jonsson 1988; Larsson 1988; 1994)
Bredasten (SW)			puppy	(Jonsson 1985; Larsson 1985)
Ertebølle (DK)			buried dog seems to be of different breed than isolated dog elements from site; has 'long, strong limb bones' and 'stout metacarpals/tarsals'	(Larsson 1990a; Winge 1900)
Koyamadai (JP)			3 young/puppy, 2 adults	(Nagamatsu 1976)
Yoshigo (JP)			3 young/puppy, 8 adults	(Hasebe 1952b; Saito 1952)
Sanganji (JP)	broken/healed vertebra			(Mori 1988)
Takanekido (JP)	broke/healed limb bone (oldest dog)		ages: 3-4 years (one dog); 5-6 years (one dog); over 12 years (one dog)	(Nishino and Okazaki 1971)
Kaitori (JP)	'healed bone injuries'		around 4.5 years old; suggested injuries were from a hunting accident	(Kusama and Kaneko 1971)
Usuiso (JP)	broken/healed right tibia	grave covered with stones	'old' dog	(Otake 1983)

Appendix 4: Additional Dog Burial Information

SITE	INJURY	GRAVE GOOD	DOG NOTES	REF
Tagara (JP)	some dogs have healed broke bones		young and old dogs; youngest 2-3 mo.	(Hirasawa 1986; Shigehara and Hongo 2000)
Soya (JP)		oyster shell bracelet (burial 2)	adult dog (burial 1) and 6-7 mo. old dog (burial 2); both dogs same size as modern Shiba Inu	(Horikoshi 1977)
Ugasaki (JP)	mandibular infection, broken/healed right femur		'old' dog; sized slightly bigger than modern Shiba Inu	(Oikawa 1980)
Karekinomiya (JP)			same size as modern Shiba Inu	(Sumiyoshi 1981)
Ishigami (JP)			newborn or fetus	(Kaneko 1977)
Nakasawame (JP)			3-4 mo. old	(Sudo 1985)
Ikawazu (JP)			all dogs are adults, most are 'old'	(Editorial Committee and of the Report of Ikawazu Shell Midden 1972)
Nishinoyato (JP)	broken/healed axis		buried in 'curled' position	(Toki 1936)
Nakazawahama (JP)			all adults dogs	(Sato 1995b)

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