FAITHFUL UNTO DEATH: THE DOG BURIALS OF THE GASTON SITE IN HALIFAX COUNTY, NORTH CAROLINA

By

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Introduction

The presence of dog burials (dogs intentionally buried upon death by their human companions) on archaeological sites is a persistent and enduring trend found across North America. As the only domesticated animal to accompany the first peoples into the Americas, the unique relationship between humans and domestic dogs (*Canis lupus domesticus*), as exemplified by their intentional burial, continues to intrigue researchers (Larson et al. 2012; Morey 2010; Perri et al. 2018; Walker and Frison 1982; Warren 2004). The how, why, and where of early dog domestication are just now unfolding largely due to phylogenetic studies over the past decade. One recent study suggests that dogs were domesticated from an ancestral wolf population in Siberia. They arrived with early humans who migrated across the Bering land bridge into North America (Leathlobhair et al. 2018; Perri et al. 2018). The study fills in the 4,500 year gap between the first human populations (pre-Clovis peoples) who arrived around 14,500 years ago and the earliest definitive evidence of intentionally interred dogs in North America (Leathlobhair et al. 2018). The earliest confirmed archaeological evidence of dogs in North America are two dog burials found at the famous Koster site (11GE4) and one dog burial found at the nearby Stilwell II site (11PK1044) in west central Illinois (Perri et al. 2018; Walker et al. 2005; Morey and Wiant 1992). All three dogs date to around 10,000 years ago during the Early Archaic period (Perri et al. 2018).

Dog burials continue to be an uncommon, yet geographically widespread, occurrence during the subsequent Middle Archaic period. The practice becomes more common in some areas during the Late Archaic period. Many Late Archaic dog burials are found within Late Archaic shell middens in the Green River Valley in Kentucky and along the central Tennessee River in Alabama (Claassen 2008; Pauketat and Sassaman 2020:243). These dogs were interred

in isolated burials in shell middens, leaving archaeologists to speculate that these burials had ritual or ceremonial significance (Claassen 2008). Despite their prevalence in some regions, dog burials are missing from the Late Archaic archaeological record in North Carolina, despite the state's many Late Archaic sites (Ward and Davis 1999:64). It should be noted, however, that many of these sites have not been subjected to intensive excavation and the state's soils are often not conducive to good bone preservation (R.P. Stephen Davis, Jr, personal communication 2020).

Some researchers believe that the practice of burying dogs became less frequent in North America during the Woodland period (Morey 2010; Warren 2004; Worthington 2008). In North Carolina, the opposite appears to be true. Dog burials do not appear in any substantial capacity *until* the Woodland period, with the highest numbers occurring during the Middle and Late Woodland periods (approximately AD 800 to 1600). Alongside the introduction of pottery-making, horticulture, and semi-sedentary villages (Ward and Davis 1999), dog burials may need to be considered a feature of Woodland period occupation, at least in some parts of North Carolina.

While dog burials and the relationship between people and their dogs have been discussed at length in other areas of North America, similar discussions have been largely relegated to gray literature and the margins of academic literature in North Carolina. My thesis seeks to remedy this gap by analyzing the dog burials found at the Gaston site (31HX7) and contextualizing my findings with a broader analysis of archaeological dog burials found in the state. I seek to answer two primary research questions: (1) Can any general patterns (temporal, geographic, cultural, etc.) be proposed from an in-depth study of dog burial distributions throughout the state? and (2) How do the dog burials at the Gaston site fit into these larger

patterns? Drawing on published literature and field notes, I first discuss the excavation of Gaston and the dog burials. I then present my analysis of the dog skeletal remains, which received only brief mention in the original site report (South 2005). Next, I consider the Gaston site dog burials within the larger context of dog burials found at sites across North Carolina, including two sites in particular, both with similarly large numbers of dog burials: Broad Reach (31CR218) and Contentnea Creek, which is also known as the Wilson site (31WL37).

The Gaston Site

The Gaston site (31HX7) is a multicomponent site in the northeastern Piedmont that was subjected to an emergency excavation in 1955 in response to the Virginia Electric and Power Company (VEPCO)'s Roanoke Rapids Reservoir hydroelectric power project (South 2005; Ward and Davis 1999). VEPCO planned to build a dam at Roanoke Rapids that would result in a nine-mile-long lake that would flood 4,900 acres of land in Halifax and Northampton counties. In a time before federal cultural heritage protection acts like the National Historic Preservation Act of 1966 (16USC470) and the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, Dr. Joffre Coe, then head of the Research Laboratories of Anthropology, which later became the Research Laboratories of Archaeology (RLA), at the University of North Carolina at Chapel Hill (UNC-CH), quickly negotiated terms to conduct a partially-funded last minute archaeological site survey within the area to be flooded by VEPCO (South 2005). Their agreement permitted RLA archaeologists to design a survey to mitigate the loss of research and data that the potential archaeological sites on these lands may have yielded. Coe (1964:90) conducted a surface survey in spring 1955 with assistance from UNC-CH graduate student Stanley South, Stanley's spouse Jewell South, and UNC-CH undergraduate student Lewis

Binford. They found 74 prehistoric sites in total and conducted test excavations at the five more promising sites that could yield intact deposits (Figure 1). The team chose the most promising site, later named Gaston, for the most intensive data recovery that subsequent summer (Figure 2). South led a small team of archaeologists in extensive excavation efforts at Gaston that lasted until rising waters from the completed dam flooded the site (Coe 1964; South 2005).

While South conducted the field data recovery efforts, both Coe (1964) and South (1959, 2005) published literature on the excavations and discoveries made at the Gaston site. With time not on their side, Coe (1964:91-92) acknowledged that South's team resorted to less traditional, time-saving methods. After eight of 25 control squares revealed excellent stratigraphy, South's team decided to use road graders and bulldozers to remove upper soil layers to access archaeological features in order to understand the site's spatial distribution. In eight designated and gridded areas, they used a bulldozer to thinly strip soil layers until the bottom of the midden was reached (South 2005). Coe (1964:91-92) recognized that this method put all of the features onto a single plane, destroying any features or parts of features that may have been higher up in the stratigraphy. This forced archaeologists to determine a feature's cultural association and relative age by its contents rather than its spatial orientation. In total, two hundred features were identified (South 2005). Fill was screened using 3/8 inch mesh (VanDerwarker 2001:3).

In addition to the photographs taken by Stanley South, Jewell South, and Lewis Binford, the Aerial Photography Field Office in the United States Department of Agriculture's Farm Service Agency captured an aerial photograph of the area where the Gaston excavation occurred in 1955 as part of their agricultural documentation of Northampton County. This image was georeferenced and included in this thesis as a map (Figure 3). The georeferencing is not exact due to a lack of permanent landmarks (such as buildings or continually used streets) that could be

observed between the 1955 and 2020 images. An aerial view of the now flooded site is also included as a map to demonstrate just how high the water rose in 1955. Now submerged under the waters of Roanoke Rapids Lake, the Gaston site lies roughly 90 meters offshore as of 2020 (Figure 4).

What archaeologists have learned from the Gaston excavations has proved to be invaluable to Southeastern archaeology. Gaston is a multicomponent village site on the south bank of the Roanoke River (Coe 1964; South 2005). With access to the river for easy navigation and a notable amount of raw lithic material available nearby, it is not a surprise that excavations yielded copious amounts of archaeological evidence indicative of frequent human use and occupation (South 2005). Middle Archaic Morrow Mountain points (approximately 7100 BC to 6000 BC) found within un-stratified contexts provide the earliest evidence of human occupation at Gaston (Coe 1964; South 2005:48, 183).

Coe and South identified six cultural periods (three pre-pottery and three post-pottery) (Figure 5). The Guilford complex, characterized by the period's characteristic points and chip-notched axes, was the earliest firmly identified period at about six feet below the ground surface (Coe 1964:118). Coe (1964:118) proposed that hearths found in this layer dated to approximately 6000 BC. The Halifax complex, characterized by side-notched points, followed with corroborating radiocarbon dates sourced from hearth features several inches above the Guilford complex (South 2005:183). A radiocarbon date taken from a hearth in this layer corresponds to approximately 3500 BC (Coe 1964:118). Separated by several inches of sterile sand, the Savannah River complex, with corroborating hearth-sourced radiocarbon dates and projectile points, is found next at 48 to 36 inches below the ground surface. A radiocarbon date taken from charcoal in this layer corresponds to approximately 2000 BC (Coe 1964:118). After 18 inches of

cultural material-free sand above the Savannah River complex, a 24-inch thick layer of midden accounts for the last three Woodland-period cultural complexes: Vincent (1000 BC to AD 300), Clements (AD 300 to 1000), and the aptly named Gaston complex (AD 1000 to 1600). These three periods correlate broadly to the Early to Late Woodland period (1000 BC to AD 1400). These three complexes were defined by different pottery types, which were found to be more or less stratified within the midden layer. Because differences between Vincent and Clements pottery are often difficult to differentiate and because Vincent does not linearly precede Clements in the archaeological record in terms of stratigraphy, both South (2005:156) and Coe (1964:27) acknowledged this muddiness during their discussions of the Gaston site and often combined the two pottery types under a general Vincent-Clements pottery type. Vincent-Clements (very broadly defined as 1000 BC to AD 1000) is commonly how these two pottery types are described in the literature.

The Gaston site was a palisaded village during the Late Woodland period. Radiocarbon dates from palisade postholes tie this village to the Gaston complex (Coe 1964). Echoing Coe, South (2005:203-204) stressed that the language group of the Native American people (Algonquian-, Siouan-, or the Iroquois-speaking Tuscarora) who resided at Gaston during the Late Woodland period cannot be easily deciphered from their material culture. Due to the distance of Gaston from the coast, it has been proposed that the people who resided there during the Late Woodland period into the early Contact period were more likely Siouan- or possibly Iroquois-speaking peoples (R.P. Stephen Davis, Jr., personal communication 2019).

The Gaston Site Dog Burials

Archaeologists recovered numerous dog burials during their excavations of the Gaston site, but their documentation and later discussions focused primarily on lithic tools, pottery, and older stratified portions of the site. The dog burials were documented sparsely and somewhat inconsistently in publications and in surviving field notes housed at the RLA. Moreover, dog burials were mentioned only in passing in the numerous publications that explore the 1955 excavation and artifacts in detail (Coe 1964; South 2005; Towers 2018; VanDerwarker 2001; Ward and Davis 1999). This vagueness made piecing together their original excavation a challenge. This section attempts to address this lack of documentation and inconsistent reporting, analyze trends, and individually document information concerning the excavation of these dog burials and their subsequent reanalysis in this thesis.

Before South published his Master's thesis about Gaston, Coe dedicated about 30 pages to the site in his landmark 1964 monograph, *The Formative Cultures of the Carolina Piedmont*. Coe (1964:92) stated that eight dog burials were found at Gaston. According to the article, dog remains were fully-articulated and buried in their own individual pits (Coe 1964:93). Coe did not specify where they were located at the site or any details about specific dog burials. He also stated that most of the dog burials "contained [white tailed deer (*Odocoileus virginianus*)] bones that may have represented an offering since they were found on the flood [sp. floor] of the pit next to the skeleton rather than loose in the pit fill" (1964:93). In his conclusion, he proposed that dog comprised a prominent portion of the Piedmont diet during the Vincent and Clements periods (Coe 1964:117-118).

In his thesis, South described the dog burial contexts as generally containing "little else than the dog, a few sherds, and very little midden" (2005:127). South (2005:126-127) identified

more dog burials than Coe for a total of 12 dog burials found in Features 40, 55, 59, 83, 85, 88, 89, 93, 94, 134, 151, and 156 and two possible dog burials in Feature 9 and human Burial 7. In South's (2005:184) interpretative analysis of the Gaston site, he determined that dog burials occurred during the Vincent-Clements and Gaston periods. South surmised that "The Late Hunters" brought dogs with them to the river basin and "had such an attachment to them that they buried them in graves, especially during their latter period of living in the basin" (2005:206). He contradicted Coe by omitting domestic dog from the list of animals hunted and consumed at Gaston.

Like Coe, South discussed deer bones as potentially associated grave inclusions within the dog burials. He found these large deer bone fragments "at the level of the dog in some burials, and not in the higher fill dirt" (2005:127). Though South had little confidence in this interpretation, he suggested that if these deer bones were indeed some sort of grave good that they could have represented an offering of meat to the dog. South did not specify which dog burials contained deer bones. Using the original faunal assemblage report that was conducted in 1959 by zoology professor Dr. Frederick Schenck Barkalow Jr. at North Carolina State University for South's 1959 thesis as reference, South may have been referring to the dog burials in Features 9, 40, 55, or 59 (South 2005). These large deer bone fragments are not currently curated with any of the dog burials, nor are they marked as potential grave goods in the current collection at the RLA. South never photographed or otherwise documented these bones in situ. Thus, any analysis of the deer bones that may have once been associated with several of the dog burials is not feasible.

This thesis omits two dog burials identified by South in Features 55 and 59 due to a lack of skeletal remains for study. South (2005:126) described the dog burial found in Feature 59 as

being in a large pit. Above this pit, a small pit with two postmolds (two on each side) was documented (South 2005:126). Both features contained Clements pottery sherds (South 2005). When Amber M. VanDerwarker (2001) reanalyzed the Gaston site's faunal assemblage as a UNC-CH graduate student, no dog bones were found in Feature 55 and only two insubstantial tooth fragments were recorded from Feature 59. The absence of skeletal remains could be the result of poor bone preservation.

During the initial organization of my thesis, it became evident that at some point between Barkalow's (South 2005) and VanDerwarker's (2001) faunal reports that transcription errors occurred in the provenience of some dog burials and general dog remains. The features identified as containing dog remains differ between the two analyses and both differ from the aforementioned features that South (2005) described as containing dog burials. Barkalow identified dog in Features 9, 19, 20, 26, 28, 40, 55, 59, 83, 93, 94, 102, 105, 134, 150, 151, 156, and 180. VanDerwarker, in comparison, identified dog in Features 2, 8, 9, 19, 20, 26, 29, 36, 40, 43, 48, 50, 59, 83, 85, 88, 93, 94, 95, 102, 134, 150, 156, 161, 173, 180, 195, 198, and 200 based on her computerized data spreadsheets that the RLA retains. Most discrepancies are not of major concern to my thesis because I primarily focus on the features that South (2005) identified as dog burials. The inconsistencies that I do need to address for this thesis, however, are the identifications of dog burials in Features 150, 151, and 161. Barkalow identified dog in Features 150 and 151, but not in Feature 161. In contrast, VanDerwarker identified dog in Features 150 and 161, but not in Feature 151. Using the original field notes, which identified a human infant associated with the dog in Feature 151, it appears that VanDerwarker's Feature 150 dog is the Feature 151 dog identified by South and Barkalow and therefore I reverted to using the Feature 151 designation for this dog burial. As for VanDerwarker's Feature 161 dog, I believe it may be

South's and Barkalow's Feature 150 or 59 dog. Not knowing this for certain and unable to find additional documentation that could explain this discrepancy, I followed the most recent analysis done by VanDerwarker and retained Feature 161 as the provenience for the dog. These inconsistencies need to be investigated further in future studies of the Gaston site.

As such, I include two newly identified dog burials (burials not previously identified as such by South) in my study. These remains are from Features 102 and 161. As I discuss in more detail in the next section, the remains show nearly complete skeletons in these features that warrant further analysis here.

In the following section, I present my analysis of 16 dog burials. I analyzed these remains using modern comparative collections housed in the RLA's Zooarchaeology Laboratory. To retain order within the collection, I assigned a Dog Burial number to each set of remains, which I ordered by Feature number in ascending order. South and his team did not number the dog burials during their original excavation and analysis, facilitating the need for them here. The data collection methodology, general descriptions, and data presentation below are modeled after Dr. Heather A. Lapham's analysis of dog burials from the Broad Reach site (Lapham et al. 2015).

Accompanying the following descriptions, Table 1 summarizes general findings for each dog burial by their assigned burial and feature number, including the general condition and completeness of the skeleton, estimated age and sex, and pathology. Table 2 shows epiphyseal fusion data collected for which epiphyseal fusion could be observed. Fusion stages, which follow Dr. Lapham's analyses, are classified as unfused (U), fusing (G), and fused (F) for the following skeletal elements: scapula (Scap), calcaneus (Calc), metacarpal (Mc), metatarsal (Mt), proximal ulna (P.Ul), distal humerus (D.Hu), proximal radius (P.Ra), distal tibia (D.Ti), distal femur (D.Fe), distal ulna (D.Ul), distal radius (D.Ra), proximal femur (P.Fe), proximal tibia (P.Ti), and

proximal humerus (P.Hu) (Lapham et al. 2015). Table 3 lays out additional excavation information per dog burial. The inconsistencies concerning dog burials between the two previous faunal analyses by VanDerwarker (2001) and Barkalow (South 1959) are outlined in Table 4.

Tables A1 through A14 in Appendix A present the measurements (in millimeters) for crania and long bones following von den Driesch (1976). If a measurement is marked with an asterisk (*), it denotes a measurement that was taken from a skeletal element sided to the right. Right-sided measurements were taken only when the corresponding left-sided element was missing or in such poor condition that no measurements could be reliably taken.

Dog Burial 1 (Associated with Human Burial 7)

South (2005) described this dog burial, found in Area C of the site, as "intruding" into human Burial 7. Two human broken distal femur ends were found under the dog's skeleton and a human distal humerus was found near the dog's pelvis (South 2005:134). He proposed that the pit where Dog Burial 1 was interred was originally above one of the two human individuals ("Pelvis #2") who were interred around the same period in Burial 7. When "Pelvis #2's" human bones were exposed, this pit was abandoned and another pit was dug over the first individual's remains. As a result, the broken distal humerus is from the "Pelvis #2" burial and the broken human femurs were from the other individual (South 2005:134). One individual was male and the other was of indeterminate sex (N.C. Archaeological Collection 2020). Both were more than 18 years old at death (N.C. Archaeological Collection 2020).

This dog burial also contained Gaston type pottery sherds, dating Dog Burial 1 to the Gaston site's latest complex (South 2005:138). South recorded that eight Gaston series pottery sherds, two Type I Fabric pottery sherds, and one Clements Cord pottery sherd were found underneath the dog (South 2005:139). It is unknown if the pottery sherds were intentionally

interred with Dog Burial 1, if they were associated with the two human burials it intruded upon, or if they appeared in the feature by some other means.

Due to its nearness to human Burial 7, Dog Burial 1 has the best documentation in the surviving field notes. Four field photographs (Figures 6 through 9), one field drawing (Figure 10), and one published thesis diagram (Figure 11) of human Burial 7 depict Dog Burial 1 in situ at various angles. The field drawing depicts that the dog was laid on its right side in a curled position with its limbs slightly curled inward. Its cranium was positioned towards the general northwest. From the photographs, the skeleton was in reasonably good condition with a mostly complete cranium, mandibles, axial elements (including vertebrae and sacrum), forelimbs, and hind limbs. Something happened to these remains somewhere between the field and the laboratory, because the current collection at the RLA contains only a few fragments of crania, mandibles, and teeth. The right mandible is largely complete whereas the left mandible is more fragmented, represented only by the mandibular body.

Dog Burial 1 appears to be an adult dog based on the field photographs, but these images lack the resolution needed to determine epiphyseal fusion for aging purposes. In terms of the surviving skeletal remains, only a fused proximal femur allows for an age estimation based on epiphyseal fusion—an element that usually fuses between six and nine months (Sumner-Smith 1966).

The dog's upper and lower teeth show severe wear. The lower permanent first molar is comparable to Stage G in Horad-Herbin (2000:117), reinforcing the dog as an older adult. Sex is indeterminate. Notably, the permanent third molar in both mandibles is missing and its sockets were reabsorbed into the alveolar bone. Dog Burial 1's fragmentary remains show no other pathological or anatomical changes or abnormalities.

Dog Burials 2A, 2B, and 2C (Feature 9)

South (2005:126) identified Feature 9, a large pit located in Area B of the site, as containing some variety of dog burials. It was unclear in his thesis whether he referred to a single dog burial or multiple dog burials in his descriptions. A dog cranium and mandible were found located at the feet of human Burial 1 and at the same level vertically with the skull (South 2005:131). South (2005:126) suspected that this skull may have been associated with a dog burial. Based on the surviving documentation of this dog cranium and mandible found with human Burial 1, a dog may have been laid to rest on its right side (Figure 12 and Figure 13). The dog cranium points in the generally northeast, but the positioning of the rest of the dog's body is unknown based on surviving documentation showing an absence of postcranial remains.

Human Burial 1 was found in the center of Feature 9, and was likely intrusive into the pit (South 2005:118-127). Marshall T. Newman of the Smithsonian Institution initially identified human Burial 1 as a 40 to 45 year old male (South 2005:209). Later analyses at UNC-CH identified human Burial 1 as a possible female aged 48 ± 9 years. Feature 9 also contained Vincent-Clements type pottery and skeletal remains from deer, bird, fish, and turtle (South 2005:163, 211). Any possible association between these artifacts and the dog burials is unknown.

In my reanalysis, I identified at least three different dogs in Feature 9 based on three right upper permanent first molars. This interpretation is backed up by the postcranial remains. One of the right femurs was much smaller than the two left femurs, indicating the remains of at least three dogs. The teeth could be readily differentiated based on distinct wear patterns. For measurements and discussion of the teeth, the dogs will be differentiated as Dog 2A, 2B, and 2C. The postcranial elements were fragmentary and difficult to separate into different individual dogs during analysis. All measurements taken from the postcranial elements in Feature 9 are marked

as Dog Burial X in postcranial measurement tables, because, unlike the teeth, they could not be separated into Dogs 2A, 2B, and 2C.

Dog Burial 2A is likely the youngest dog amongst the three dogs as its mandibular and maxillary teeth exhibit no wear. Its lower permanent first molar is comparable to Stage A in Horad-Herbin (2000:117), establishing it as a young dog. All of its permanent lower teeth, including its third molar, are fully erupted, but the fragmentary status of the remains make it difficult to confidently age the dog. Some fragments of its maxillary bone and a portion of its left mandible survive. Dog Burial 2A shows no pathological or anatomical changes or abnormalities. Sex is indeterminate.

Dog Burial 2B is likely an adult dog as evidenced by occlusal wear on its erupted upper fourth permanent premolar, first molar, and second molar. It cannot be confidently aged based on surviving fragmentary remains. Some of the right maxillary bone also survives. Dog Burial 2B shows no pathological or anatomical changes or abnormalities. Sex is indeterminate.

Dog Burial 2C is also an adult dog based on notable occlusal wear on its erupted upper permanent canine, second incisor, fourth premolar, first molar, and second molar. It cannot be confidently aged based on surviving fragmentary remains. Some maxillary bone fragments also survive, showing the molars as completely erupted. Dog Burial 2C shows no pathological or anatomical changes or abnormalities. Sex is indeterminate.

Based on the teeth and the epiphyseal fusion data from the postcranial remains (labeled Dog Burial X in the tables), it is likely that there are the remains of at least three comingled dogs who were at least 18 months at death within Feature 9. The strongest evidence for at least three co-mingled dogs comes from the femurs. There are two sets of sided left and right femurs and one much smaller additional femur shaft fragment. No epiphyseal fusions exist for the smaller

long bone fragments (including the aforementioned small femur) suspected to be associated with Dog 2A that could narrow down its age. Several long bones from this feature bear evidence of post-depositional rodent gnawing. No bones could be sexed. The long bones otherwise show no pathological or anatomical changes or abnormalities.

Dog Burial 3 (Feature 40)

South (2005:126) identified Feature 40 as containing a dog burial. Feature 40 was described as a pit feature with four postmolds forming a square around the pit (South 2005:126). No documentation survives depicting this dog burial in situ. Feature 40 was found in Area B. The feature also contained the skeletal remains of deer and turtle (South 2005:212).

The remains of this burial are in poor condition with incomplete skeletal elements. It consists of a few cranial fragments, loose teeth (none suitable for aging, but exhibiting some wear indicative of a younger adult dog), some vertebral fragments (including a portion of the atlas), portions of the left and right pelvis including the acetabulum, and some long bone shaft fragments. Based on these fragmentary remains, Dog Burial 3 is a notably larger adult dog. Based on all observable epiphyseal ends being fused, this dog was at least 18 months old at death (cf., Seoudi 1948; Silver 1969; Smith and Allcock 1960; Sumner-Smith 1966). No age can be determined from the available teeth. Sex is indeterminate. The lower first permanent premolar tooth is missing and its socket is reabsorbed into the mandibular alveolar bone. No other pathological or anatomical changes or abnormalities were identified.

Dog Burial 4 (Feature 83)

South (2005:127) identified Feature 83 as an intentionally-dug pit containing a dog burial. No documentation survives depicting this dog burial in situ. Feature 83 was found in Area D.

The remains of this dog are in poor condition and its skeletal remains are fragmentary. The remains include some cranial fragments (notably a good portion of the premaxilla), most of the right mandible, loose teeth, three vertebrae fragments, and some long bone fragments. Dog Burial 4 was an adult dog of intermediate age but on the older side with a lower permanent first molar comparable to Stage E in Horad-Herbin (2000:117). Sex is indeterminate.

This dog likely had a moderate tooth root abscess, evident in the lower first permanent molar socket within the alveolar bone in the right mandible (Figures 14 through 17). This infection led to the partial absorption of the first permanent molar's root and the loss of the permanent fourth premolar, the second molar, and possibly the third molar if the dog possessed one. The sockets from these two, potentially three teeth, were reabsorbed in the alveolar bone. No other pathological or anatomical changes or abnormalities were identified.

Dog Burial 5 (Feature 85)

South (2005:127) identified Feature 85 as an intentionally-dug pit containing a dog burial. No documentation survives depicting this dog burial in situ. Feature 85 was found in Area D.

The remains of this dog are in poor condition. The fragmentary remains include portions of a few cranial fragments, loose teeth, and both mandibular bodies. The lower permanent first molar is comparable to Stage F in Horad-Herbin (2000:117), indicating that this dog was an adult of intermediate age. Sex is indeterminate. The dog retained its lower permanent third molar on its right mandible but is missing the same tooth on its left mandible. The socket for the lower permanent third molar on the left mandible is absorbed back into the alveolar bone. No postcranial elements are present to age based on epiphyseal fusion. No other pathological or anatomical changes or abnormalities were identified.

Dog Burial 6 (Feature 88)

South (2005:127) identified Feature 88 as containing a dog burial. Feature 88 was described as a pit feature with four postmolds forming a square around the pit (South 2005:126). No documentation survives depicting this dog burial in situ, but a more detailed field drawing was made of the feature this dog burial was found in (Figure 18). Feature 88 was found in Area F.

The skeletal remains are in poor condition. The surviving fragmentary remains include a few cranial fragments, loose teeth, one portion of the left mandible, a few vertebral fragments, and a portion of the right femur shaft. Though it appears that this dog is a younger adult based on mandibular tooth eruption and wear patterns, its permanent first molar is too damaged to confidently age following Horad-Herbin (2000:117). No postcranial bones survive to determine age based on epiphyseal fusion. Sex is indeterminate. The left mandible experienced some undetermined post-depositional damage near the third permanent premolar. This dog does not have a permanent third molar in the surviving left mandible, having likely lost the tooth in life and having its socket reabsorbed into the alveolar bone. No other pathological or anatomical changes or abnormalities were identified.

Dog Burial 7 (Feature 93)

South (2005:127) identified Feature 93 as an intentionally-dug pit containing a dog burial. No documentation survives depicting this dog burial in situ. Feature 93 was found in a single excavated unit between Area F[1] and G. Dog Burial 7 was listed as "Dog Burial #1" in the RLA collection despite no previous mention of any numbering systems in publications on Gaston. It is renumbered in this thesis.

The skeletal remains of Dog Burial 7 are in poor condition. The surviving fragmentary remains include cranial fragments, some loose teeth, one portion of the right mandible, the left mandibular condyle, vertebral fragments, rib fragments, and several long bone fragments. The lower permanent first molar is comparable to Stage E in Horad-Herbin (2000:117), indicating an adult of intermediate age. No epiphyseal fusion can be observed for aging. Sex is indeterminate. No pathological or anatomical changes or abnormalities were identified.

Dog Burial 8 (Feature 94)

South (2005:127) identified Feature 94 as an intentionally-dug pit containing a dog burial. No documentation survives depicting this dog burial in situ. Feature 94 was found in a single excavated unit between Area F[1] and G. Dog Burial 8 is listed as "Dog Burial #2" in the RLA collection. It is renumbered in this thesis.

The skeletal remains of Dog Burial 8 are in poor condition. The surviving fragmentary remains include cranial fragments, portions of the right and left mandible, and most of the atlas. No other postcranial elements survived. Sex is indeterminate. The lower permanent first molar is comparable to Stage F in Horad-Herbin (2000:117), indicating an adult of intermediate age. It has an intact permanent third molar in its left mandible. Considerable rodent gnawing is evident on both the buccal and lingual sides of the left mandible, including an unusual indentation on the alveolar bone on the buccal side under the first permanent molar. No pathological or anatomical changes or abnormalities were identified.

Dog Burial 9A and 9B (Feature 102)

South (2005:118) identified Feature 102 as a garbage pit in Area B. He noted that the feature contained a high percentage of Vincent type pottery (South 2005:162) and faunal remains from dog, deer, raccoon (*Procyon lotor*), turtle, and fish (South 2005:214). This feature piqued

our curiosity because VanDerwarker's analysis of the faunal assemblage identified over 300 dog bones and teeth in this feature. When I analyzed these remains, I was pleased to be able to sort these bones into two almost complete juvenile dog skeletons. No field records survive indicating that these two dogs were identified during excavation. Based on the completeness of the skeletal remains, I believe they represent two dog burials, either interred alongside one another or perhaps an earlier burial disturbed by a later burial.

Dog Burial 9A is the younger of the two dogs from Feature 102. The condition of the remains is fair. The cranium and mandible are largely absent from the burial with only a few small fragments surviving. The postcranial elements are more complete. All long bones except for the fibula are accounted for in the right and left forelimbs and hind limbs. All observed epiphyses (long bones, pelvic bones, metapodials, scapula, and vertebral bodies) are unfused. Based on the presence of an unfused scapula in addition to all other elements being unfused, it is likely that this dog was less than three months old at death (cf., Seoudi 1948; Silver 1969; Smith and Allcock 1960; Sumner-Smith 1966).

Dog Burial 9A's lower permanent first molar (which consisted of only the crown) is comparable to Stage A in Horad-Herbin (2000:117), also indicating that this was a young dog. Though no deciduous teeth survive, the three permanent teeth associated with this dog are represented only by crowns (no roots), which, along with thin enamel and discoloration, is characteristic of teeth in young dogs that have not yet erupted through the gum line. Sex is indeterminate due to its age. No pathological or anatomical changes or abnormalities were identified.

Dog Burial 9B is the older of the two dogs found in Feature 102 based on epiphyseal fusion. The condition of the remains is fair. The surviving skeletal remains include cranial

fragments, a portion of the left mandible, teeth, vertebrae (with unfused bodies), and all long bones except for the fibulae. This dog is missing one scapula, portions of the pelvic bones, along with various carpals, metacarpals, tarsals, and metatarsals. Although the proximal ulna is unfused, the distal humerus end is fusing and the pelvis is fused. The rest of the long bone proximal and distal ends are unfused. The only fusions observed on this dog are the fused pelvic bones. Using the epiphyseal fusion data, this dog was likely around five to seven months old at death (cf., Seoudi 1948; Silver 1969; Smith and Allcock 1960; Sumner-Smith 1966).

Though no deciduous teeth were found, the permanent teeth associated with this dog have roots unlike Dog Burial 9A. Its lower permanent first molar is comparable to Stage A in Horad-Herbin (2000:117), also indicative of a young dog. Sex is indeterminate due to its age. A permanent third molar socket is present on the dog's left mandible, indicating that all of the dog's lower permanent molars were erupted. No pathological or anatomical changes or abnormalities were identified.

Dog Burial 10 (Feature 134)

South (2005:127) identified Feature 134 as an intentionally-dug pit containing a dog burial. One field drawing survives depicting this burial in situ (Figure 19). Feature 134 was found in Area C. The dog was laid on its right side in a curled position with its limbs slightly curled inward. Directionality is indeterminate as the field drawing was otherwise unmarked. From the drawing, the skeletal remains appear to be fairly complete with an intact cranium, mandible, postcranial axial skeleton, forelimbs and hind limbs.

The condition of the fragmentary skeletal remains in the RLA collection is poor. Surviving skeletal elements include cranial fragments, loose teeth, portions of both mandibles, scapulae, several long bone fragments, a broken calcaneus, and several metapodial fragments.

Sex is indeterminate. Its lower permanent first molar is comparable to Stage G in Horad-Herbin (2000:117), indicative of an older mature adult. This dog retains its permanent third molar in the left mandible. No pathological or anatomical changes or abnormalities were identified.

Dog Burial 11 (Feature 151)

South (2005:127) identified Feature 151 as an intentionally-dug pit containing a dog burial. Feature 151 was found in Area A, the northernmost portion of the site and closest to the river. A field drawing depicts that the body was laid on its right side in a curled position with its limbs slightly curled inward (Figure 20). The direction to which the cranium was positioned is undetermined based on this drawing. It appeared that the skeleton was found remarkably complete at a depth of 24 inches in the feature.

South (2005:127) documented that human Burial 14, a fetus, was found with the skeletal remains of Dog Burial 11 in Feature 151. South may have misidentified Feature 150 for 151 on page 138 within his thesis when he discussed Burial 14. South (2005:138, 214) stated that Barkalow found the fetal remains during the laboratory analysis of the faunal assemblage with Dog Burial 11. He theorized that the reason why human Burial 14 was not found in the field was because it was buried directly underneath Dog Burial 11 and went unnoticed during excavation. Curiously enough, the aforementioned field drawing clearly depicts and labels the remains of a "Human Foetus" in Feature 151 between Dog Burial 11's curled forelimbs and hind limbs, but the fetus appears to be penciled in after the initial drawing was made, perhaps in hindsight of Barkalow's discovery in the lab. Ultimately, it is unclear whether the dog and human fetus were intentionally interred alongside one another or not.

Dog Burial 11 is the best-preserved dog found at Gaston. It is a nearly complete adult male dog with an intact baculum (penis bone). The cranium is the most fragmentary skeletal

element, but the occipital bone is intact. Based on epiphyseal fusion, this dog was at least 18 months old at death, but likely much older based on the wear of its teeth (cf., Seoudi 1948; Silver 1969; Smith and Allcock 1960; Sumner-Smith 1966). Its lower permanent first molar is comparable to Stage F in Horad-Herbin (2000:117), indicative of an adult dog of intermediate age. The socket of the lower permanent first premolar is reabsorbed into the alveolar bone in the right mandible. The dog retains his permanent third molar in the right mandible. With the only well-preserved set of vertebrae at Gaston, Dog Burial 11 has mildly curved (or bent) spinous processes on one lower thoracic vertebra and on his first through the sixth lumbar vertebrae (Figures 21 through 23). When viewed from the cranial perspective, the first, second, and sixth lumbar vertebrae lean left and the third, fourth, and fifth lumbar vertebrae lean right. The fourth lumbar vertebra has the most severely curved spinous process. The first lumbar vertebra also has mild osteophytes on the vertebral body.

Dog Burial 12 (Feature 156)

South (2005:127) identified Feature 156 as an intentionally-dug pit containing a dog burial. Barkalow identified the faunal remains of raccoon, gray squirrel (*Sciurus carolinensis*), turtle, bird, and fish within the feature (South 2005:214). No documentation survives depicting this dog burial in situ. Feature 156 was found in Area G.

This dog's skeletal remains are in poor condition. The surviving fragmentary elements include a few cranial fragments, loose teeth, portions of both mandibles, a few vertebral fragments, scapulae fragments, and the long bones from the forelimbs. The posterior half of the dog is largely missing. Its lower permanent first molar is comparable to Stage G in Horad-Herbin (2000:117), indicative of an older adult dog. The epiphyseal fusions are also all complete on the

existing postcranial elements, indicating that the dog was at least 18 months old at death (cf., Seoudi 1948; Silver 1969; Smith and Allcock 1960; Sumner-Smith 1966). Sex is indeterminate.

Dog Burial 12 likely had a moderate tooth root abscess, evident in the lower first permanent molar socket within the alveolar bone of the right mandible and on the root of the corresponding lower permanent first molar (Figures 24 through 27). Some swelling is also present in the alveolar bone beneath the lower permanent fourth premolar, but the root is still intact and anchored in the jaw so it was difficult to tell if this tooth was also infected. No other pathological or anatomical changes or abnormalities were identified.

Dog Burial 13 (Feature 161)

South (2005:118, 205) identified Feature 161 as a garbage pit that contained deer or elk bone, but no dog remains. Using VanDerwarker (2001) for this interpretation, this analysis found that dog bones *were* present in Feature 161 and that they represented a single individual with a somewhat complete skeleton, thus identifying it as a dog burial. Please see page 9 for further discussion on this dog's unclear provenance. Feature 161 was found in Area G.

The condition of this dog's remains is fair. The surviving skeletal elements include large cranial fragments, most of the vertebrae and ribs, two sternum fragments, and most of the long bones except for the right radius and both fibulas. Based on the epiphyseal fusions, Dog Burial 13 was at least 18 months old at death (cf., Seoudi 1948; Silver 1969; Smith and Allcock 1960; Sumner-Smith 1966). Sex is indeterminate, but features of the pelvic bones suggest male. All cranial and mandibular bones, including teeth, are absent from the collections for aging. No pathological or anatomical changes or abnormalities were identified.

Summary and Radiocarbon Results

My study identified 16 dog burials in total (see Table 1). While several dog burials were in good condition, most of them (11 out of 16 dogs, or 69%) are represented by fragmented remains. The mandibles and teeth are the best represented elements from this collection, leading most age estimates to be completed based on tooth wear analyses. A total of 11 dogs could be assigned to general age categories (juvenile, young adult, intermediate adult, and older adult) following Horad-Herbin (2000). Eight dogs, excluding the comingled Dog Burial X, could also be aged by epiphyseal fusion. Seven dogs could be aged by both methods. From these two aging methods, it was determined that this population is comprised of two juvenile dogs (Dog Burials 9A and 9B), one dog that could either be an older juvenile or a young adult (Dog Burial 2A), two intermediate adult dogs older than 18 months old (Dog Burials 3 and 13), seven mature adult dogs (Dog Burials 4, 5, 7, 8, 11, and 12), and two older adult dogs (Dog Burials 1 and 10). Dog Burials 2B and 2C lack the necessary elements to be aged by either methods, but are likely adult dogs due to the occlusal wear present on their teeth. Also, due to this collection's fragmentary nature, only one male dog (Dog Burial 11) is definitively sexed due to the presence of a baculum.

Six dogs demonstrate some sort of pathology. Two adult dogs (Dog Burials 4 and 12) have evidence of periodontal disease in the form of mandibular tooth infections (possible tooth root abscesses). Five dogs (Dog Burials 1, 4, 5, 6, and 11) had antemortem tooth loss, most either missing their lower permanent third molars or their lower first premolars. One dog (Dog Burial 11) has curved (or bent) spinous processes on his thoracic and lumbar vertebrae.

With funding assistance from Honors Carolina and the RLA, I submitted two bone samples in late January 2020 to DirectAMS in Bothell, Washington, for accelerator mass

spectrometry (AMS) radiocarbon testing to help determine when these dogs were buried at the Gaston site. One sample, a right humerus shaft fragment, comes from Dog Burial 11 ("DB-12" upon submission). The other sample, a left proximal humerus shaft fragment, comes from Dog Burial 13 ("DB-14" upon submission). Dog Burial 11 was chosen because of its completeness and possible association with human Burial 14. Dog Burial 13 was chosen due to its postcranial completeness. I received the resulting dates on March 9, 2020. Dog Burial 11 dates to 640 ± 25 BP uncalibrated. When calibrated, the calendric age is 614 ± 39 BP or AD 1336 ± 39 (CalPal 2007). This dog likely lived, died, and was buried during the middle of the Gaston complex. Due to its close proximity, human Burial 14 could also date to this period. Dog Burial 13 dates to 1042 ± 24 BP uncalibrated. When calibrated, the calendric age is 954 ± 14 BP or AD 996 ± 14 (CalPal 2007). This date means that this dog likely lived, died, and was buried sometime during the late Vincent-Clements complex. These two dates support South's hypothesis that the occupants of the site buried dogs during the Vincent-Clements period and well into the Gaston period. These radiocarbon dates confirm beyond dating with ceramic types that the practice of burying dogs spanned several centuries at Gaston. The report received from DirectAMS is included here as Appendix B.

Spatial Distribution of the Dog Burials

Based on the plethora of post features in the general area of the dog burials, it seems that some dogs were buried in residential areas near households. Features containing dog burials were found both within the Gaston complex-era palisaded village (Features 9, 40, 88, 93, 94, 151, 156, and 161) and immediately outside of it (Burial 7 and Features 83, 85, 102, and 134). Except for Dog Burial 13 in Feature 161, it is unknown if any of these burials correlate to the time period

when the village palisade would have been erected, making any possible interpretation of dogs as liminal space markers or guardians a possibly unsound interpretation (Fitzgerald 2007:52).

Dog burials were found to be often interspersed among or buried in proximity to other dog burials or to human burials at Gaston. Dog burials that were buried in close proximity to each other, perhaps in loosely organized cemeteries, include: Features 83 and 85 on the easternmost side of the site outside of the palisade wall; Features 93 and 94, which are within the palisade and generally near the center of the site; and Features 156 and 161 on the northernmost side of the site nearest to the river.

The dog burials that were found in the general proximity of a human burial include the following: Dog Burial 1, which was either intrusive to or included with human Burial 7; the Dog Burials 2A, 2B, and 2C in Feature 9 found near human Burial 1; the fetus (human Burial 14) found directly underneath Dog Burial 11 in Feature 151; and Dog Burials 9A and 9B in Feature 102, which were found in close proximity to human Burial 6 who was initially identified as an indeterminately sexed adult who was more than 30 years old at death) (South 2005:210). Human Burial 6 was later determined to represent three individuals (N.C. Archaeological Collection 2020). These three individuals are represented by two men older than 21 years at death and one indeterminately sexed individual aged at least 18 years at death (N.C. Archaeological Collection 2020). Features 40 and 134, which are in general proximity to excavated human burials but further away than the aforementioned dog burial features, also represent dog burials placed in close proximity to human graves.

Only a portion of the Gaston site was excavated. When the 13 features containing dog burials were mapped over Gaston's site map, it is evident that some possible patterns pertaining

to the dog burials remain obscured due to how much was left unexcavated, likely due to the time crunch South and his team were under.

A Broader Exploration of North Carolina Sites with Dog Burials

To better contextualize and understand the significance of dog burials found at the Gaston site, I created a list of other sites in North Carolina with dog burials (Table 5). I compiled this list from the combination of a literature review and emailed inquiries to archaeologists in the state. In total, I was able to confidently identify 16 sites that have dog burials. I found this list difficult to due to the aforementioned lack of available literature and the limited published discussions. Many field reports archived with the state government are not available to researchers without an in-person appointment with the Office of State Archaeology (OSA) in Raleigh, North Carolina. Other sites lack an official archived report with the OSA or are left unrecognized by the OSA and are without a state site number. As a result, some North Carolina sites with dog burials are inevitably missing in this analysis.

Most discussions about dog burials in the state link them geographically to the coast and the Algonquin-speaking peoples who resided there during the Late Woodland period (Anderson and Horak 1993). Coastal peoples during the Late Woodland period have a long documented relationship with their dogs, both ethnographically and archaeologically (Fitzgerald 2009). Some researchers go so far as to recognize the Carolina coast as a dog burial hotspot comparable to the quantities found elsewhere, such as in Florida (Zimmer 2007). It should be recognized, however, that many sites with dog burials, including Gaston, are located farther inland on the Coastal Plain and in the Piedmont (Figure 28). No dog burials were identified in the mountains within the state, and no archaeological sites with dogs are further inland than in Yadkin County. This

finding means that more than *just* Algonquin-speaking peoples along the North Carolina coast buried their dogs during the Middle to Late Woodland period.

Most sites (n=13) also contained only a few dog burials, usually of between one and five dogs. The Gaston site is an exception in this capacity with a minimum of 16 dog burials (as found in this examination). There are two other known exceptions to this "less than five dog burial pattern" in North Carolina. The two other exceptions, Broad Reach (31CR218) and Wilson, or as it will be called in this thesis, Contentnea Creek (31WL37), are the only North Carolina archaeological sites that are directly comparable to Gaston in terms of their quantities of dog burials. These sites have 18 and 19 dog burials respectively.

Gaston is a unique site, being one of only three known sites in North Carolina to contain comparatively large numbers of dog burials. In order to better contextualize the significance of Gaston's dog burials in North Carolina, this subsequent analysis will begin with a discussion of Broad Reach and Contentnea Creek and their dog burials, followed by a discussion of the patterns, differences, and similarities between these three dog populations and their associated dog burial practices.

The Broad Reach Dog Burials

The Broad Reach site (31CR218) in Carteret County is a well-documented North Carolina archaeological site with a large number of dog burials. It is a multicomponent village and medium-sized shell midden site that encompasses about 50 acres on a broad terrace south of Sikes Creek and overlooking Bogue Sound on the North Carolina coast (Millis 2011:6-1). The site contains evidence for Archaic occupation and, more importantly, at least two periods of human occupation during the Middle to Late Woodland periods that occurred between 300 BC to

AD 1500 (Mathis 1993; Lapham et al. 2015:1, 36). These two periods are defined by pottery from the White Oak phase (indicative of a Late Woodland Algonquin-speaking population) and the Hanover phase (indicative of a Middle to Late Woodland Siouan-speaking group migrating northward into the area) (Lapham et al. 2015:36). White Oak type sherds were found in two dog burials and Hanover type sherds were found in six dog burials, indicating that both of the people groups that used these ceramic vessels buried dogs at Broad Reach (Millis 2011:6-9).

The Broad Reach site was first surveyed in 1987 (Mathis 1999). A series of volunteer excavations followed from 1991 to 1992 under Mark A. Mathis and the OSA (Millis 2011). They found 15 human burials at the site in various burial configurations from bundle burials to ossuaries (Mathis 1999). Among these 15 burials, one of the bundle burials had what has been tentatively identified as a puppy among its grave goods (Mathis 1999; Monahan 1995).

Dr. Heather A. Lapham (Lapham et al. 2015) analyzed 18 dog burials found during the 2006 excavations conducted by TRC Companies with Heather Millis as principal investigator. This excavation resulted from a Coastal Area Management Act (CAMA) permit issued prior to development of the area (Lapham et al. 2015:54). Most of the dogs were buried on their side in a curled position, though a couple had their limbs fully extended. No preferred burial orientation was observed. The puppy bundle burial from Mathis's excavations was not a part of this analysis (Heather A. Lapham, personal communication 2020).

One burial (Dog Burial 3) had two whelk shells interred with it (Lapham et al. 2015:37). Aside from this one instance of possible grave goods, no other artifacts were noted with the dogs. Though association is unlikely, maize (*zea maize*) fragments were also found within one unspecified dog burial feature (Millis 2011:6-3).

Lapham confidently sexed six of the adult dogs (two female and four male). For aging, she determined that five dogs were juveniles less than a year old based on epiphyseal fusion and tooth eruption. Eleven dogs were determined to be adults older than one year and were further separated into four age categories: young (n=3), indeterminate (n=2) mature (n=4), older (n=2). (Lapham et al. 2015:47).

Nine of the dogs had notable pathologies. A single juvenile dog had a malformed forelimb. Five adult dogs possessed healed fractures from broken bones (Lapham et al. 2015:49). Three adult dogs had antemortem tooth loss (Lapham et al. 2015:49). Three other adult dogs exhibited bony lipping on their phalanges (Lapham 2015:49). The rest of the pathological changes she observed were related to vertebrae. Five of the older adult dogs had evidence of vertebral osteophytosis (or spondylosis deformans) in the form of bony projections called osteophytes that form on the vertebra body's ventral circumference. They tend to mostly affect the lumbar vertebrae, but can also affect the cervical and thoracic vertebrae as exemplified in one of these dogs (Lapham et al. 2015:47). Two dogs also possessed a different vertebral pathology in the form of curved spinous processes on lumbar vertebrae, which have been argued to be associated with load-bearing activities. One other dog had what was described as an "irregular spinous process tuberosity" and evidence of a spinous process fracture (Lapham et al. 2015).

Most importantly, Lapham noted that no suspected dog burials had evidence of burning or cut marks. Due to the absence of these telltale markings combined with the age of many of the dogs, she argued that dogs were not consumed as sustenance at Broad Reach. Instead, these dogs were cared for by humans for long periods of time and interred into the earth upon their death by the humans they lived alongside (Lapham et al. 2015:49).

The Contentnea Creek Dog Burials

The Contentnea Creek site (31WL37) in Wilson County is located on a terrace on the east bank of Contentnea Creek (Millis 2009:2). The site was likely used for food resource procurement and occupied seasonally in the late fall and/or early winter (Millis 2009). Contentnea Creek is the least discussed archaeological site when compared to Broad Reach or Gaston in the sparse academic literature concerning dog burials. The site was excavated in 2000 by TRC Companies with Heather Millis as principal investigator. Discussions about the site and its findings are found primarily in the state's gray literature.

Lapham (2001) analyzed the dog burials from Contentnea Creek. Of the 21 dogs found at the site, Lapham and the excavating archaeologists believed that 19 of them could have been intentionally interred (Lapham 2001; Millis 2009:414). All of the pits contained a single dog burial with one exception: Feature 3484 containing the skeletal remains of two dogs. The contexts for most of the remains resembled either pit burials or pits used for a special function, as most of the dog bones were found at or near the base of the features akin to a pit burial (Lapham 2001:6). Some pit features (Features 2380, 98, 3765) had dog elements found higher up in the pit feature fill, closer to the feature's surface than the base (Millis 2009:121; 184; 215). These dog elements were exposed by the backhoe used to remove the topsoil. Seven features (98, 506, 2431, 2750, 2912, 2921, and 3765) were un-datable by context. Nine features with a potential dog burial (30, 845, 1367, 2380, 2843, 2932, 3336 and 3484) were connected to a Late Woodland-era Mount Pleasant occupation (AD 980-1290) based on the presence of pottery (Millis 2009:428). Contentnea Creek was a critical site for contextualizing the sand-tempered Mount Pleasant type as a pottery style present not just in the Middle Woodland period but that also extended into the Late Woodland period (Herbert 2011:4-10). Three features (548, 3738,

and 4060) were connected to a Late Woodland occupation through Untyped Series 1 and Untyped Series 2 pottery or similar Late Woodland diagnostic artifacts (Millis 2009:428).

Most of the dog burials were highly fragmentary. Lapham (2001) recognized that for most of the burials, only the head (cranium, mandible and/or teeth) and the first few cervical vertebrae (commonly the axis and atlas) were recovered due to poor site preservation. Some dog burials were in better shape than others. For example, Feature 2932 was a circular pit that contained enough dog bones to demonstrate articulation (Millis 2009). Due to the fragmentary nature of the remains, these dogs were unable to be sexed or aged and pathologies were unable to be observed.

While a few of the dog burials were found isolated from other dog or human burials, most of the dog burials at Contentnea Creek were found clustered and interspersed among other dog and human burials. On the easternmost part of the site, eight dog burial features were found interspersed among four human burials in the "Eastern Cluster" (Millis 2009:414, 416). On the westernmost part of the site, a similar phenomenon occurred in the "Western Cluster," with three dog burials interspersed among nine human burials (Millis 2009:416). It is unclear whether the spatial association between the dog and human burials was intentional or of an unintentional and intrusive nature, but an association likely does not exist between the two based on carbon dating taken from a feature in the Eastern Cluster (Millis 2009:450).

Excavators did not mention if grave goods were recovered from the potential dog burials, so it is unclear if any of these potential dog burials contained items that could be considered grave goods. Based on the poor condition of the dog burials themselves, any organic items potentially interred with the dogs may be degraded beyond recognition. Several features with dog burials contained other artifacts such as projectile points, but these artifacts were unlikely to

be associated with the burial based on where they were found in the feature (for example, Features 3336 and 2750) (Millis 2009).

No dog bones recovered from the site bore evidence of butchering (cut or slash marks) or other types of processing (like burning) (Lapham 2001). Dog was determined to not be a food source for the inhabitants at the site (Lapham 2001; Millis 2009).

Discussion

Gaston, Broad Reach, and Contentnea Creek have *some* general similarities beyond dog burials. They are all sizable prehistoric sites with evidence of long-term use during the Woodland period (Figure 29). The sites are located directly adjacent to water (Gaston to the Roanoke River, Contentnea Creek to Contentnea Creek, and Broad Reach to Bogue Sound) (Figure 30). The major similarities end here. While Gaston and Broad Reach can be generally classified as village sites, Contentnea Creek is interpreted as a seasonal procurement site. Pottery, though having a strong presence at all three sites, are predictably different at each site during the Middle to Late Woodland periods. Gaston has Vincent-Clements and Gaston pottery types (South 2005; Coe 1964). Broach Reach has Hanover and White Oak pottery types (Lapham et al. 2015). Contentnea Creek has Mountain Pleasant and unspecified Late Woodland pottery types (Millis 2009). From the various pottery types and the radiocarbon dates taken from these three sites, a definite pattern found in North Carolina is that the pre-contact Native peoples who practiced burying dogs in pits were diverse in language and culture, and the sites they occupied were diverse in location and time (although most dog burials occurred sometime during the Middle or Late Woodland period). My analysis of the Gaston site dog burials and comparisons with dog burials at Contentnea Creek and Broad Reach help to illustrate that some

level of enduring consistency existed in how different Native groups treated their canine companions in life and in death during the late Middle Woodland to early Contact periods, but especially during the Late Woodland period.

What other patterns can be observed from the dogs at these three sites? Firstly, dogs who were buried at these three sites were likely not being consumed as a regular source of sustenance (Lapham 2001:6; Lapham et al. 2015:49). Evidence of dog consumption can include "(1) presence of butchery markings associated with carcass dismemberment and defleshing, (2) partially burned or charred remains, and (3) the deposition of scattered, disarticulated material in features or middens along with other sustenance debris" (Lapham 2001:6). While true that many of Gaston's and Contentnea Creek's dog burials are highly fragmented due to poor preservation, no modifications such as cut marks or butchery marks have been observed on any dog bone amongst the 53 dog burials in total from these three sites. While a skilled butcher could prepare a dog without nicking bone, it is notable that not a single skeletal element in a collection of thousands of dog bones has evidence for butchering.

None of the dog bones demonstrated evidence of burning or charring either, despite the bones of other animals used for sustenance (such as deer) bearing evidence of burning and/or charring at all three sites. This is especially notable for the faunal remains at Contentnea Creek, where over 50% of the mammal skeletal elements (besides dog) showed evidence for burning (Lapham 2001:6). Both Gaston and Broad Reach, however, contain many disarticulated and isolated dog bones. With the long periods of occupation at these two sites, one could argue that these disarticulated and isolated elements could be disturbed, scattered and/or redeposited dog burials. Still, none look like they have been subjected to fire.

If dogs were ever consumed by the people at these three sites, dog consumption may have been infrequent and held significant meaning. Ethnographic accounts show that dogs were often killed as part of religious rituals in many Iroquois- and Algonquian-speaking communities in feasting contexts, in mourning rituals, and/or in war preparations (Fitzgerald 2009:23-24). The question of how often this form of dog consumption may have occurred in North Carolina could be obscured in the already poor organic preservation record that North Carolina's soils garner.

Secondly, it could be argued that dogs in North Carolina were not commonly used as pack animals. Dogs at both Gaston and Broad Reach bear evidence of curved (bent) spinous processes. Though this pathology has been classically associated with load-bearing activities, recent discussions about curved spinous processes seek to break this association (Janssens et al. 2018; Lawler et al. 2016). Analyses of modern, non-load bearing dogs reveal curved spinous processes similar to the ones found in archaeological specimens. Archaeologists and veterinary professionals have recently proposed that many incidences of curved spinal processes may just be a natural variant resulting from the fluctuating asymmetry of dog vertebrae (Janssens et al. 2018). As such, Dog Burial 11 from Gaston may not have been subjected to load-bearing activities and may instead have had an asymptomatic and non-pathological curvature in the spines of his thoracic and lumbar vertebrae.

If this interpretation of curved spinous processes as a natural variant holds water, dogs may still have functioned as working animals. Hunting dogs are a promising interpretation. Trained dogs are often an indispensable part of the hunter's toolbox (Perri 2013:134-135). Using their stamina, refined sense of smell, and strength, dogs can assist in procuring both large and small game under orders (Perri 2013:134-135). This ability of dogs to act like independent partners to their human hunter counterparts reduces the amount of energy that people had to

spend procuring meat in many hunting methods and strategies (Perri 2013:134-135). Some of these strategies include: chasing and treeing (making the prey climb up a tree for the hunter to spear or shoot), sighting or scenting prey, and corralling and/or exhausting large game such as white-tailed deer to make it safer and easier for the human hunters to kill the animal (Perri 2013:134-135). Ethnographic accounts from the general area of these archaeological sites record Algonquin-speaking groups in Virginia using their dogs in the hunts of bear, wild turkey, and other animals (Fitzgerald 2009:25). The purported inability to bark, but instead to howl like wolves, in pre-contact southeastern dogs may have been a desired trait of Native hunters to minimize the noisiness that hunting dogs are liable to make (Blick 2000; Fitzgerald 2007; Perri 2013).

Not all dogs may have been used as hunting dogs. While Native peoples may not have as strictly bred dogs as Europeans did in the late nineteenth century, the morphological size variations that have been observed in dog remains may suggest that the roles dogs played in life varied in accordance to their physical attributes (Worthington 2008).

Lastly, it can be proposed that the Native peoples of North Carolina practiced generally similar dog burial practices across the state. Aside from the possible bundle burial found at Broad Reach during the 1991-1992 excavations (one that was not analyzed by Lapham), the dogs documented in situ at all three sites were buried in a similar and consistent manner that are somewhat akin to how humans were often buried in these communities during this general time period. Similarities include the use of pit burials and bodies placed in flexed or sleep-like positions. Potential grave goods were also observed by excavators at Gaston and Broad Reach, though the legitimacy of the Gaston deer bones as grave goods is questionable.

The dog burials found at Gaston and Broad Reach show that humans at both sites buried dogs of all ages and sexes. Most of these dogs are older adults, indicating that these animals were able to survive within lower stress environments aided by humans. From what can be observed, both sites' dogs have generally healthy-looking skeletal remains with no substantial evidence of significant trauma or long periods of food stress (such as in the form of enamel hypoplasia as noted by Losey et al. 2014) that could have resulted in death. Instead, most observed pathologies were minor afflictions or a result of age. Even peritoneal disease, evidence of which is found in both the Gaston and Broad Reach dogs, is a common pathology found in modern pet dog populations. In short, these dogs were consistently looked after.

Dog burials were found alongside and in close proximity to human burials at all three sites. There is no clear delineation between these two types of burials. While direct association may be unclear because of how prolonged the occupations at all three sites were, it stands to surmise that this association between the two could be of some symbolic or ritual value, though radiocarbon dating would be needed to support this sort of association as a hypothesis. If the complete patterns at Gaston are anything similar to the spatial layout of Contentnea Creek's dog burials, additional dog burials and human burials may have been left unexcavated at Gaston.

In ethnographic accounts from the Chesapeake Bay area, dogs often play liminal roles in Iroquoian and Algonquian mythology. They often take the form of psychopomps, intermediaries, guards, or fellow travelers between realms of the worlds of the living and the dead (Fitzgerald 2009:37). If the people who resided at these three archaeological sites held similar beliefs about dogs, these populations may have found the burials of dogs amongst their dead to be of some sort of significant meaning.

Conclusions

People have had intense and intimate relationships with their dogs for millennia. The pre-contact people of North Carolina and their dogs are no exception. Though an uncommon and rarely documented phenomenon in the state, the practice of burying dogs first appears in Woodland period. The dog burials at Gaston are consistent with many of the patterns and observations found at the Broad Reach and Contentnea Creek. All three sites primarily use pit burials for dogs. Gaston has dog burials interred in the general area of other dog burials and human burial features just like the burials at Broad Reach and Contentnea Creek. Evidence of butchery and charring or burning are absent from dog bones at all three sites, indicating that these dogs were not regularly consumed as sustenance. The dogs at Gaston and Broad Reach display some pathologies and anatomical abnormalities consistent with each other, including bent spinous processes and peritoneal disease. The demographic analyses reveal that the ages of the dogs buried at Gaston and Broad Reach range from very young dogs to considerably older dogs, but that older adult dogs dominate both sites. The advanced ages of these dogs combined with a lack of skeletal evidence for malnutrition or severe disease indicate that people likely provided and cared for these dogs over long periods of time.

The occupation periods and locations represented by the Gaston, Broad Reach, and Contentnea Creek dog burial populations make this trio ideal for broader stable isotope analyses, phylogenetic studies, and other future investigations that aim to expand our understanding of the relationships between the pre-contact Native peoples and domesticated dogs of North Carolina and the greater American Southeast.

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Figures

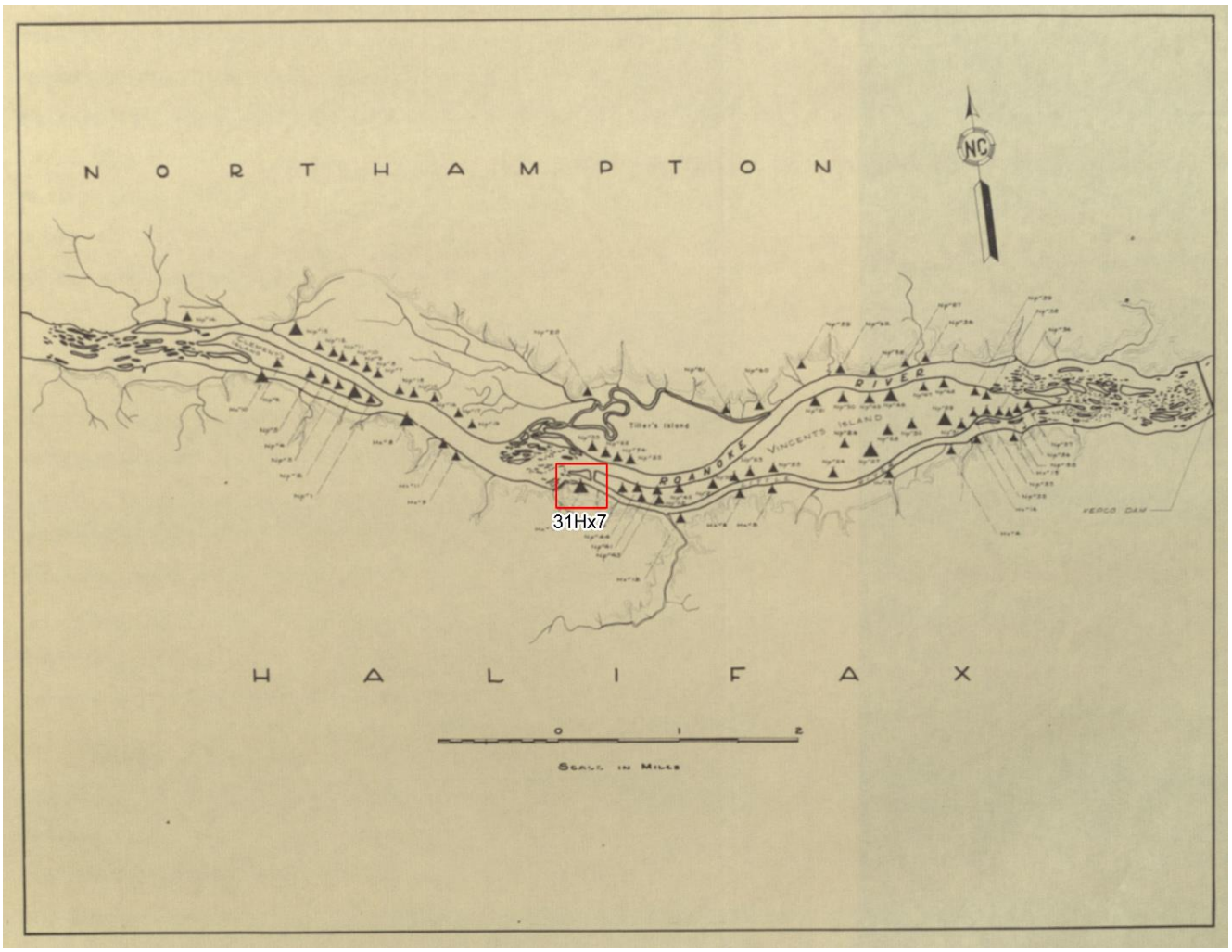

Figure 1. The Roanoke Rapids Basin Showing the Location of Native American Sites Found During the Survey, including the Gaston site (31HX7) (South 1959).

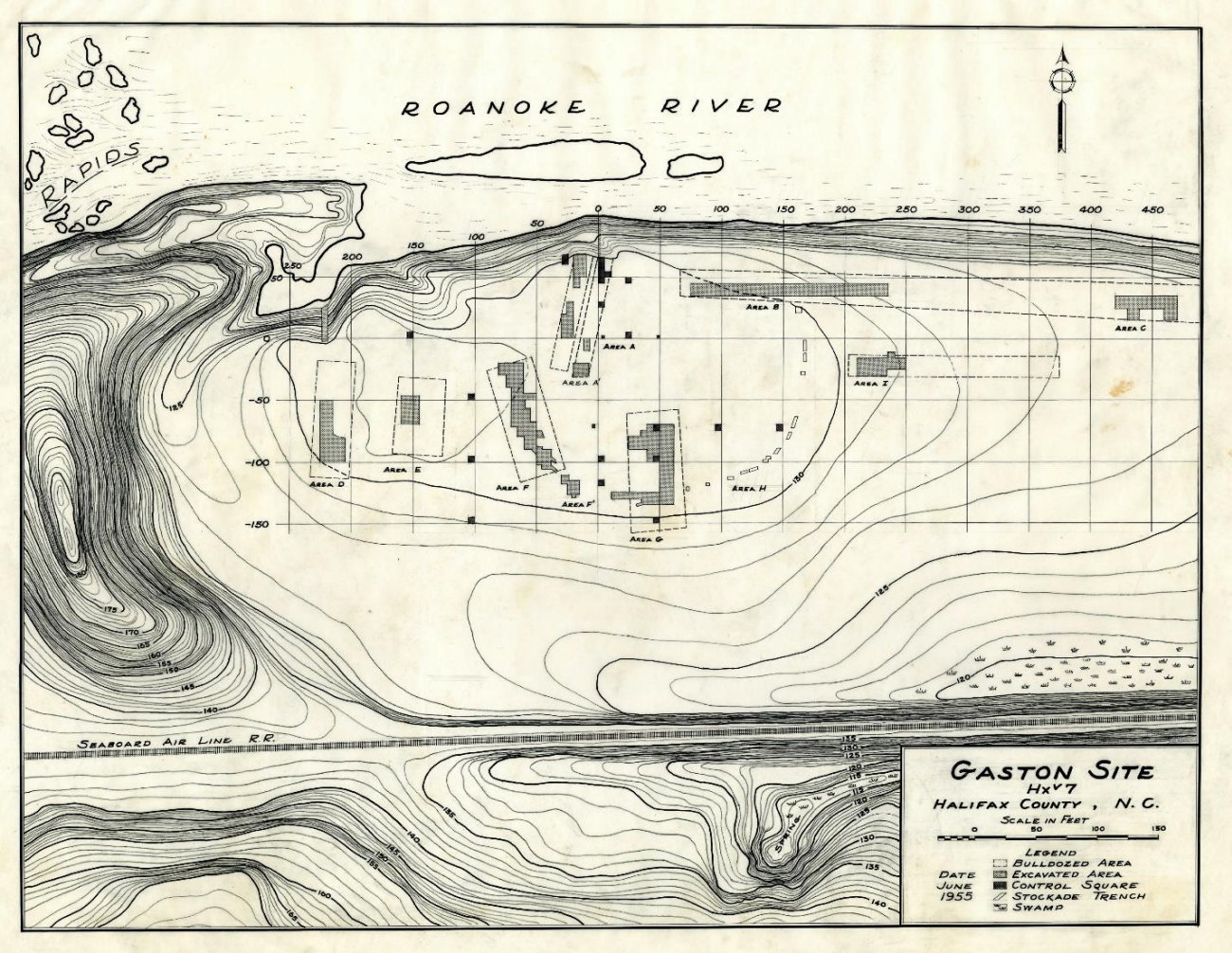

Figure 2. Original Excavation Map of the Gaston Site (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

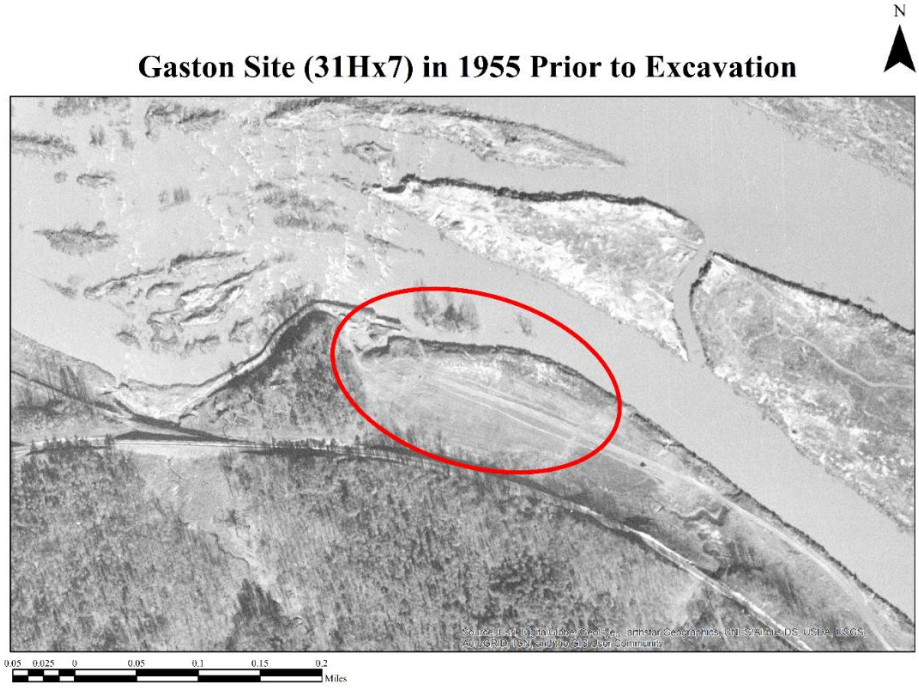

Figure 3. Map of the General Area of the Gaston Site in 1955 Prior to Excavation (Courtesy of the United States Department of Agriculture's Farm Service Agency).

Figure 4. Map of the Gaston Site in 2020 Submerged (Courtesy of Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community)

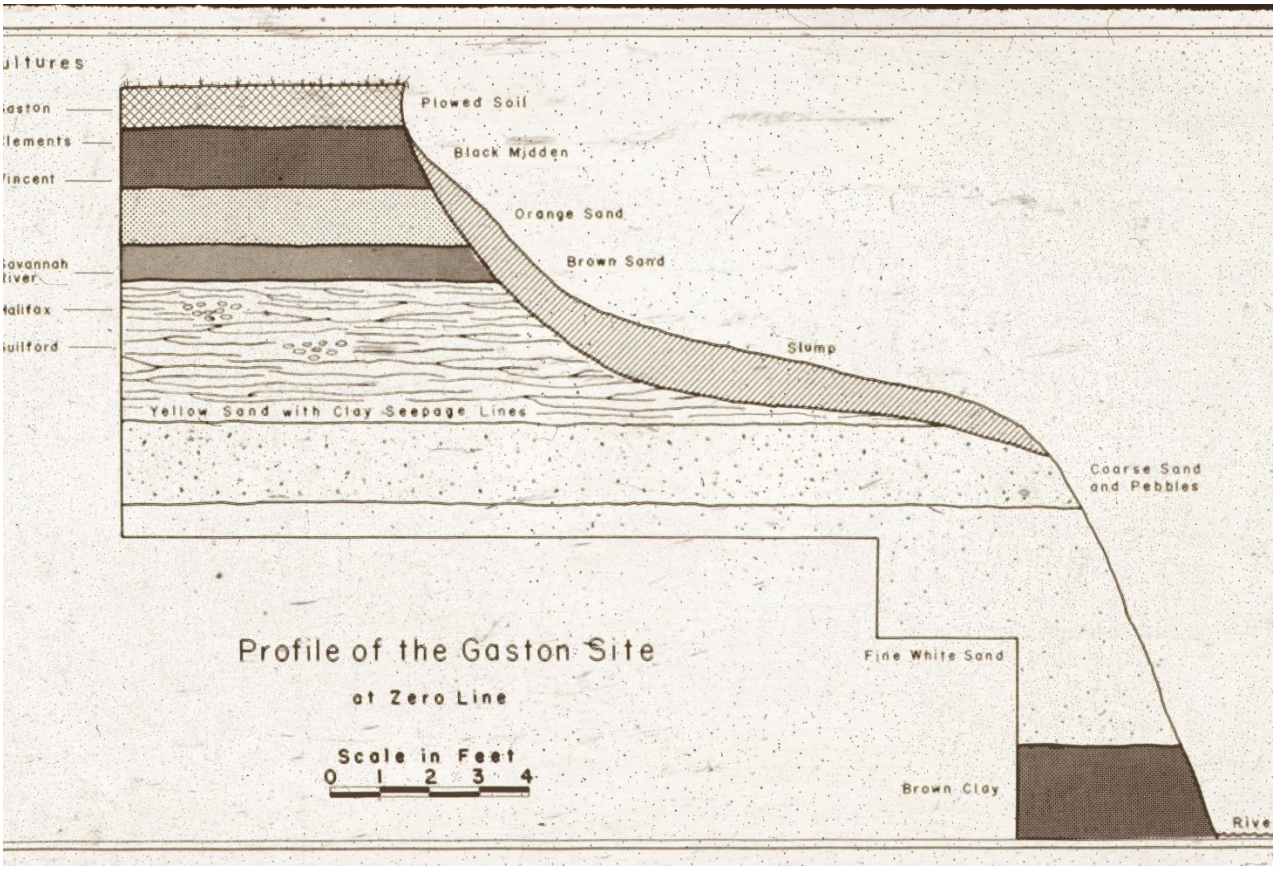

Figure 5. Stratigraphy of the Gaston Site (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

Figure 6. Dog Burial 1 (View 1) (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

Figure 7. Dog Burial 1 (View 2) (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

Figure 8. Dog Burial 1 (View 3) (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

Figure 9. Dog Burial 1 (View 4) (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

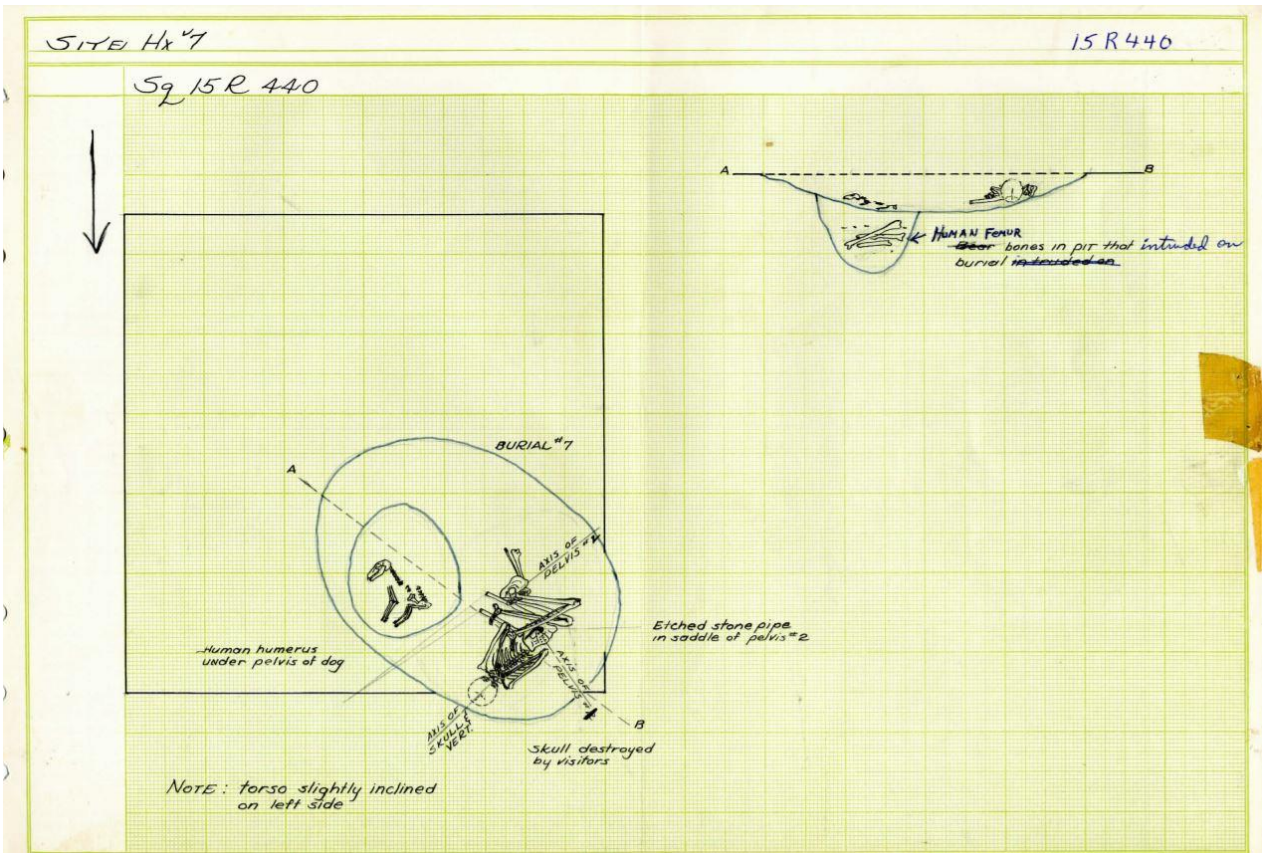

Figure 10. Field Drawing of Dog Burial 1 and Human Burial 7 (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

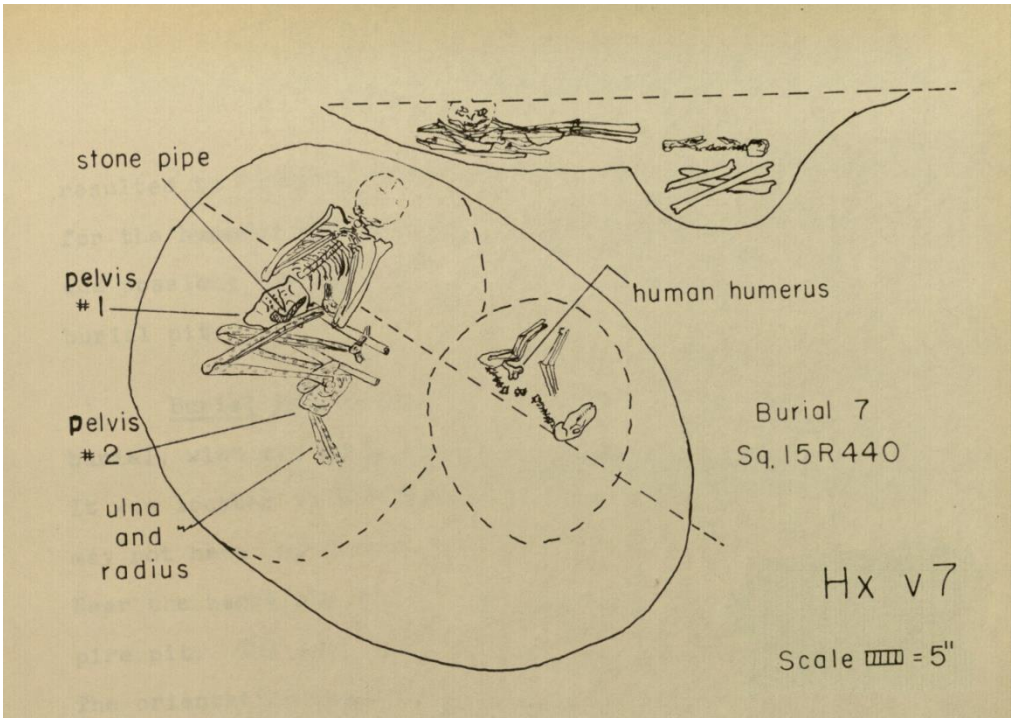

Figure 11. Thesis Drawing of Dog Burial 1 and Human Burial 7 (South 1959).

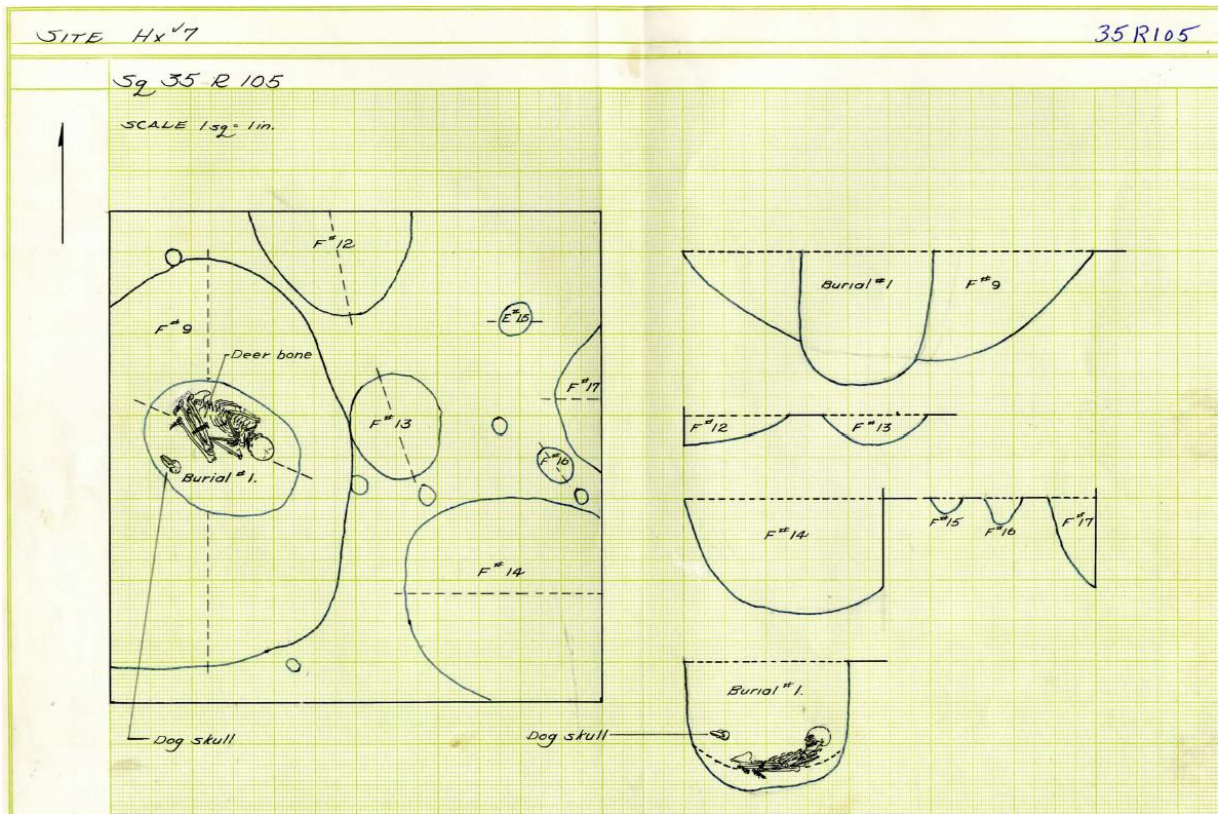

Figure 12. Field Drawing of a Potential Dog Burial in Feature 9 and Human Burial 1 (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

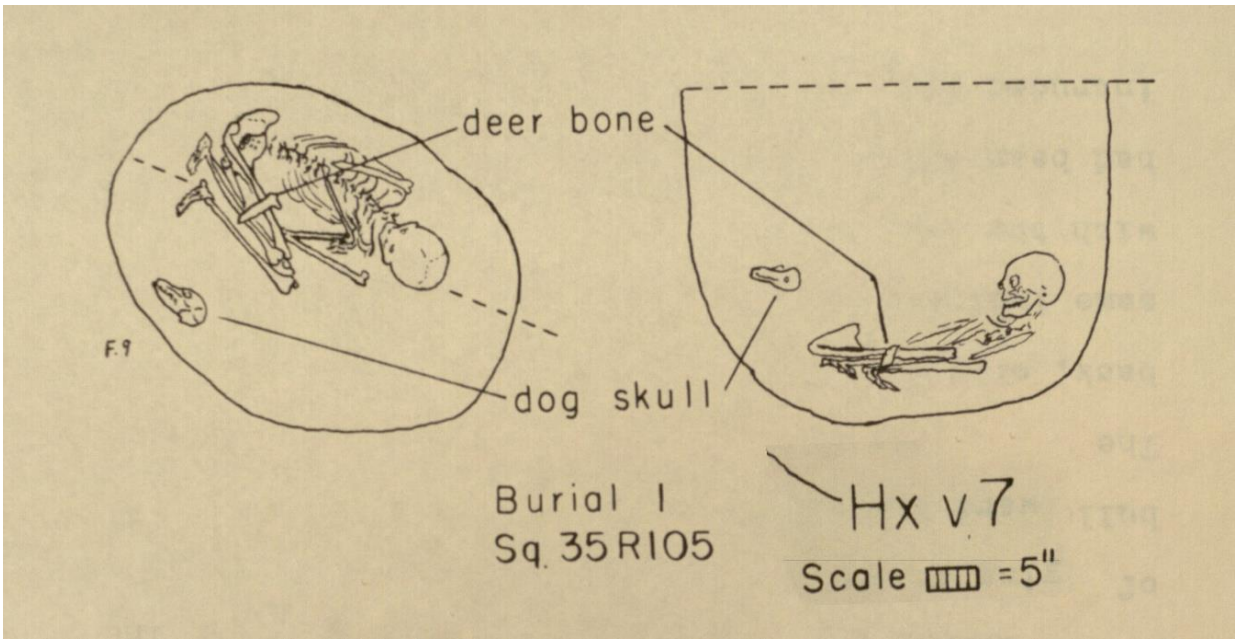

Figure 13. Thesis Diagram of a Potential Dog Burial in Feature 9 and Human Burial 1 (South 1959).

Figure 14. Infection in Right Mandible of Dog Burial 4 (with the First Molar in Socket).

Figure 15. Infection in Right Mandible of Dog Burial 4 (with First Molar Removed from Socket).

Figure 16. Mandibular First Molar (Buccal View) of Dog Burial 4.

Figure 17. Mandibular First Molar (Lingual View) of Dog Burial 4.

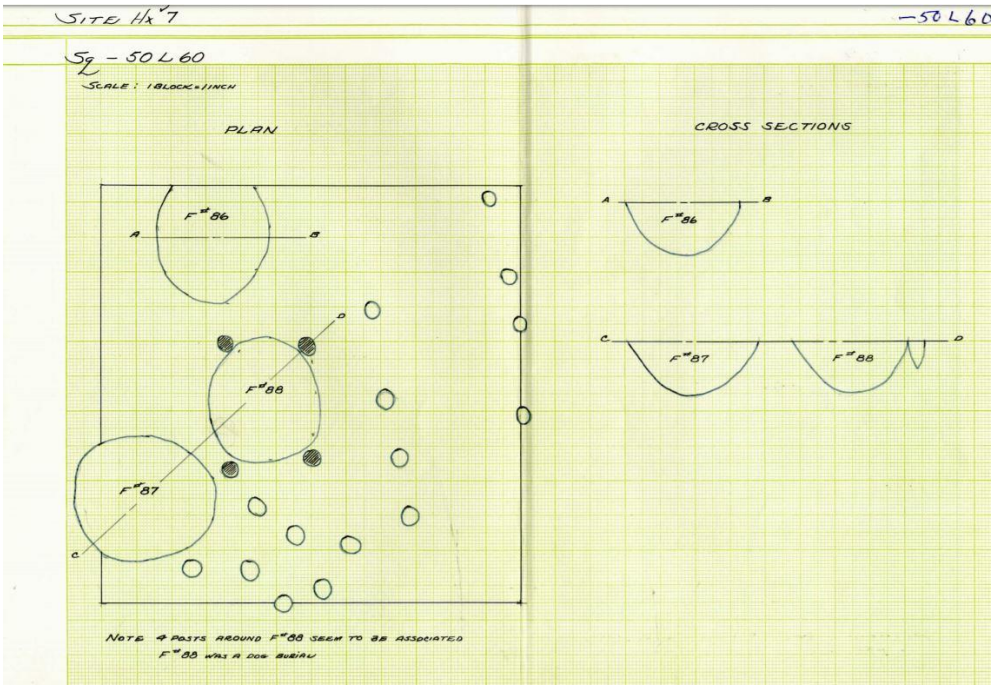

Figure 18. Field Drawing of Feature 88 (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

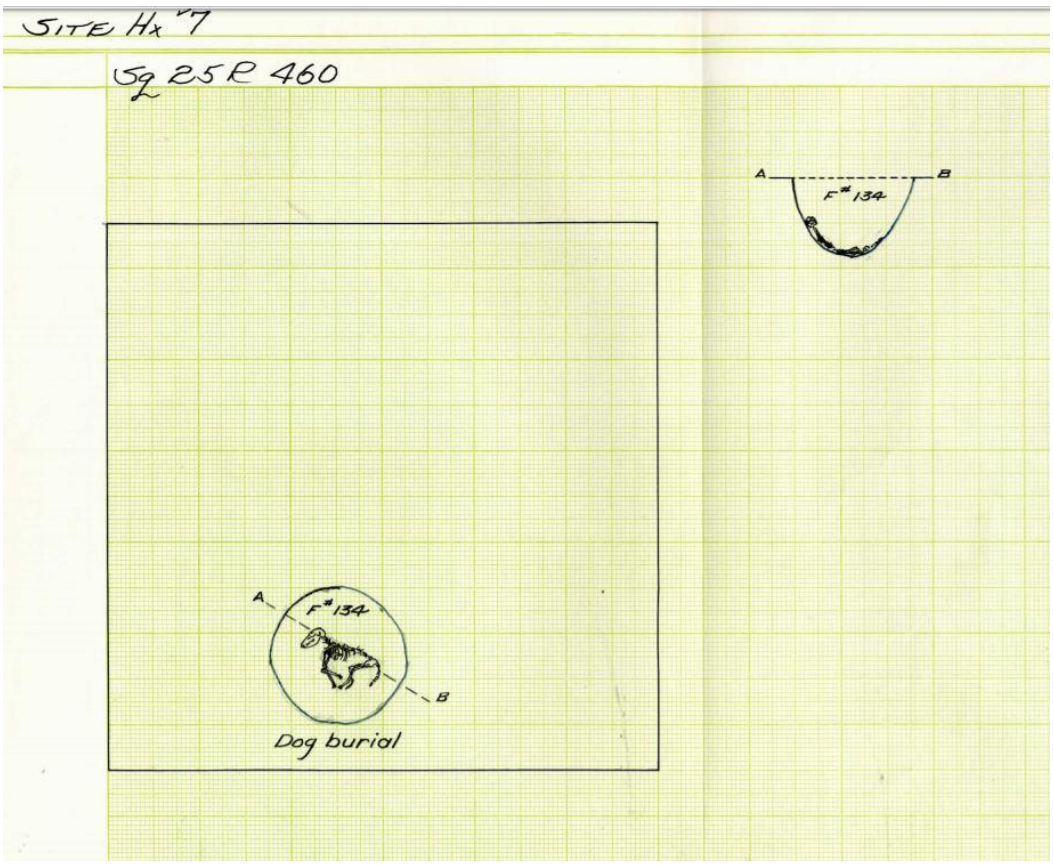

Figure 19. Field Drawing of Dog Burial 10 in Feature 134 (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).

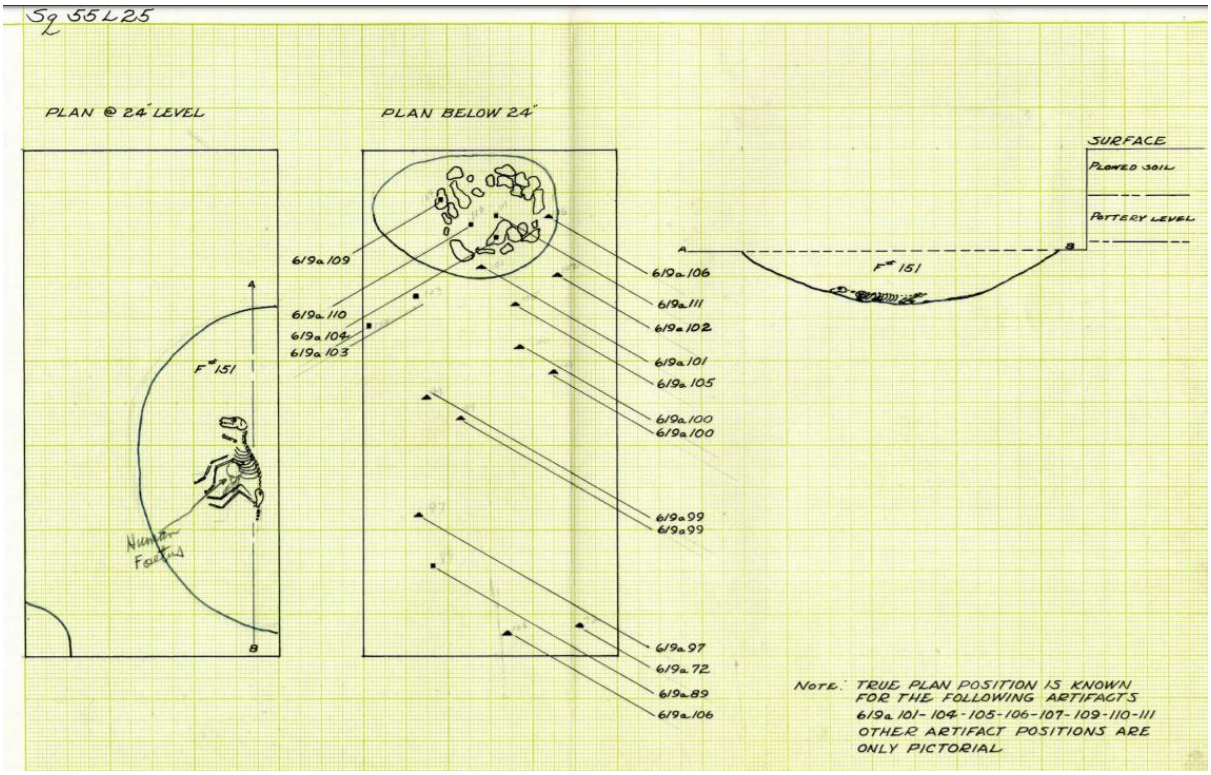

Figure 20. Field Drawing of Dog Burial 11 in Feature 151 (Courtesy of the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill).


Figure 21. Healthy Thoracic Vertebra from a Modern Domestic Dog (left) Compared to an Affected Vertebra (right) from Dog Burial 11 (Caudal Perspective).

Figure 22. Healthy Lumbar Vertebra from a Modern Domestic Dog (left) Compared to Affected Vertebrae (right) from Dog Burial 11 (Cranial Perspective).

Figure 23. Healthy Lumbar Vertebra from a Modern Domestic Dog (left) Compared to Affected Vertebrae (right) from Dog Burial 11 (Caudal Perspective)

Figure 24. Infection in Right Mandible of Dog Burial 12 (with First Molar in Socket).

Figure 25. Infection in Right Mandible of Dog Burial 12 (with First Molar Removed from Socket).

Figure 26. Mandibular First Molar (Buccal View) of Dog Burial 12.

Figure 27. First Molar (Lingual View) of Dog Burial 12.

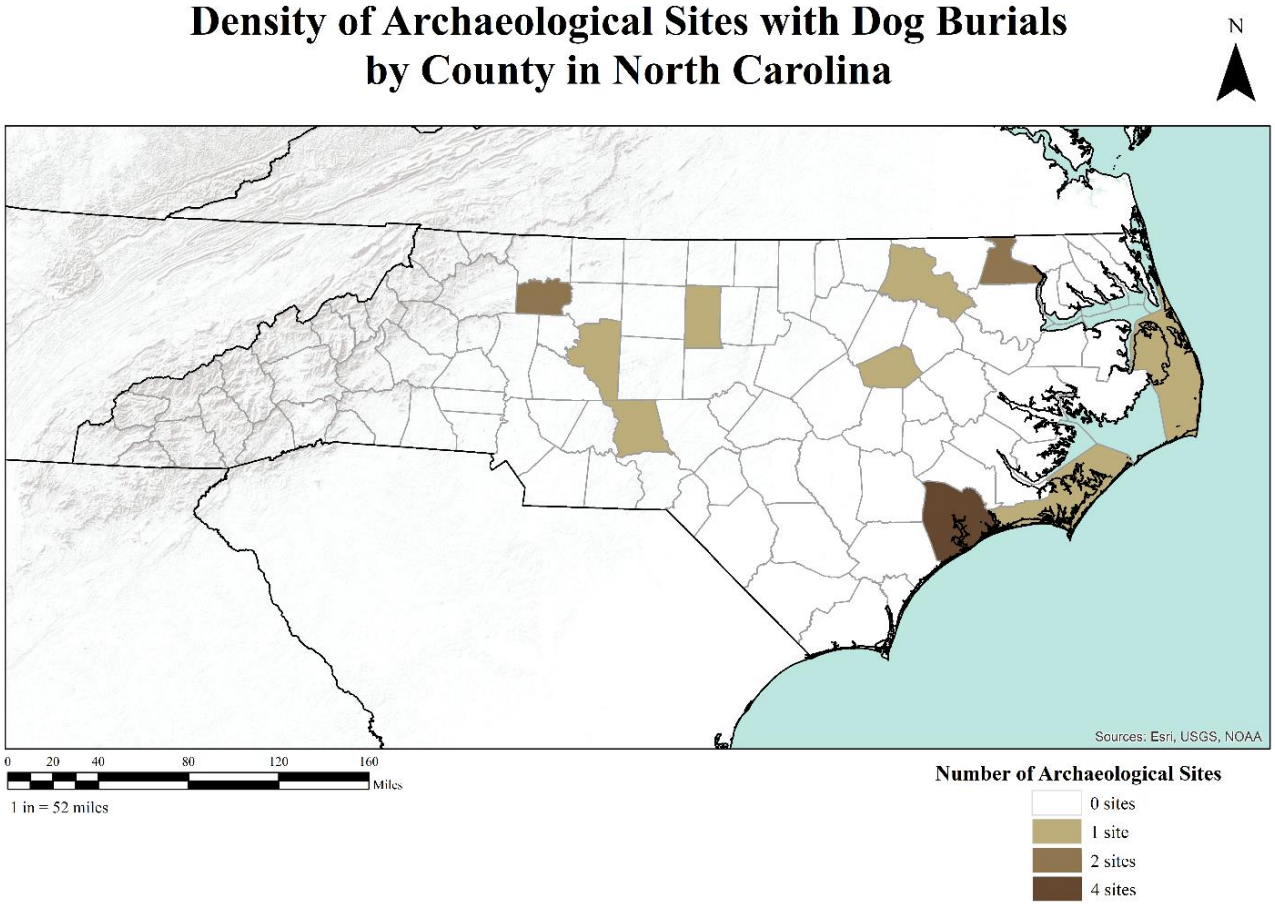

Figure 28. Density Map of North Carolina Archaeological Sites with Dog Burials by County.

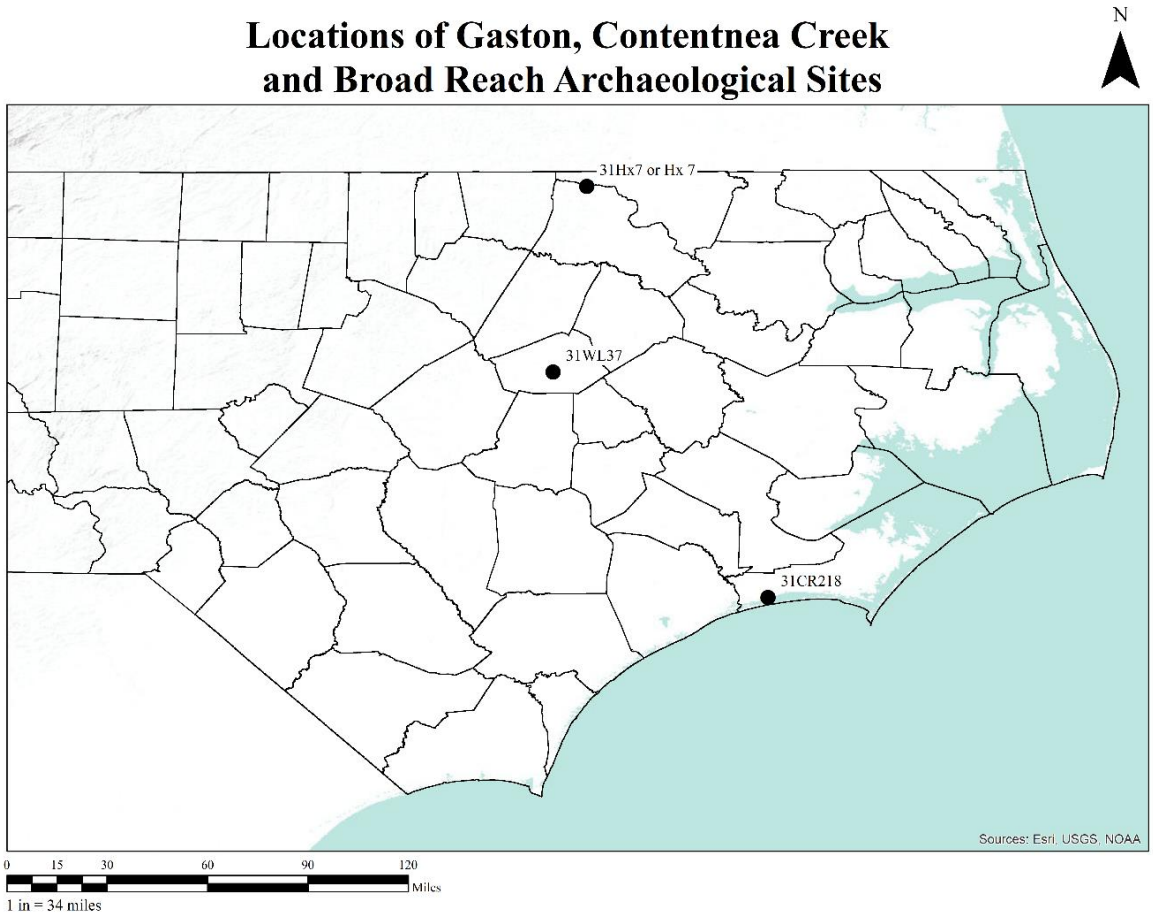

Figure 29. Map of Locations of Gaston (31HX7), Contentnea Creek (31WL37), and Broad Reach (31CR218) Archaeological Sites.

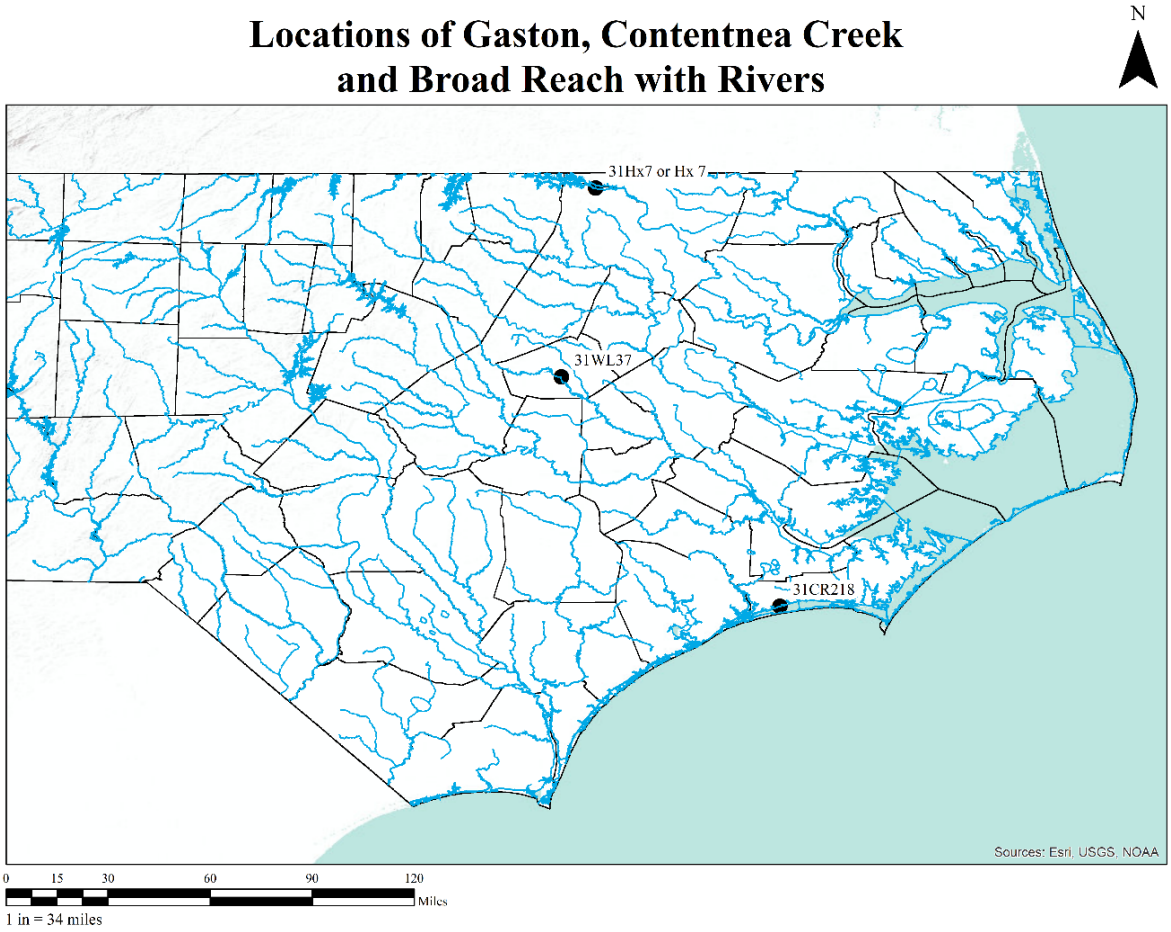

Figure 30. Map of Locations of (31HX7), Contentnea Creek (31WL37), and Broad Reach (31CR218) Archaeological Sites with Rivers.

Tables

Table 1. General Summary of the Gaston Dog Burials*

Burial No.	Feature No.	Skeletal Completeness	Bone Condition	Sex	Epiphyseal Fusion Age	Age: H-H Stage	Age Group	Pathological Changes Observed
1	B.007	incomplete	poor	unkn.	>18mo	Stage G	older adult	no
2A	F.009	incomplete	poor	unkn.	too frag.	Stage A	young adult	no
2B	F.009	incomplete	poor	unkn.	too frag.	n/a	adult	no
2C	F.009	incomplete	poor	unkn.	too frag.	n/a	adult	no
X	F.009	incomplete	poor	unkn.	>18mo	n/a	adult	no
3	F.040	incomplete	poor	unkn.	>18mo	n/a	no teeth	yes
4	F.083	incomplete	poor	unkn.	>18mo	Stage E	interm. adult	yes
5	F.085	incomplete	poor	unkn.	too frag.	Stage F	interm. adult	yes
6	F.088	incomplete	poor	unkn.	too frag.	n/a	adult	yes
7	F.093	incomplete	poor	unkn.	too frag.	Stage E	interm. adult	no
8	F.094	incomplete	poor	unkn.	too frag.	Stage F	interm. adult	no
9A	F.102	mostly com.	fair	unkn.	<3mo	Stage A	juvenile	no
9B	F.102	mostly com.	fair	unkn.	6-9mo	Stage A	juvenile	no
10	F.134	incomplete	poor	unkn.	>7mo	Stage G	older adult	no
11	F.151	mostly com.	good	male	>18mo	Stage F	interm. adult	yes
12	F.156	incomplete	poor	unkn.	>18mo	Stage F	interm. adult	yes
13	F.161	mostly com.	fair	unkn.	>18mo	n/a	no teeth	no

**Age: H-H Stage field is based on Horad-Herbin (2000). Intermediate adult (interm. adult).*

Table 2. Epiphyseal Fusion of the Gaston Dog Skeletons*

Burial No.	Scap	Calc	Mc	Mt	P.Ul	D.Hu	P.Ra	D.Ti	D.Fe	D.Ul	D.Ra	P.Fe	P.Ti	P.Hu	Pelvis	Fusion Age	Fusion Age Class
1												F				>18mo	3- mature adult
2A																	
2B																	
2C																	
X	F		F		F	F	F				F	F	F		F	>18mo	3- mature adult
3		F	F	F	F				F		F	F			F	>18mo	3- mature adult
4							F		F							>18mo	3- mature adult
5																	
6																	
7																	
8																	
9A	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0-3mo	1a- juvenile
9B		F			U	G	U	U	U	U	U	U	U	U	F	5-7mo	1b- juvenile
10				F												>7mo	
11	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	>18mo	3- mature adult
12	F				F	F	F			F				F		>18mo	3- mature adult
13	F	F	F	F	F	F	F	F	F			F	F	F	F	>18mo	3- mature adult

**Epiphyseal fusion is classified as unfused (U), fusing (G), and fused (F) for the following skeletal elements: scapula (Scap), calcaneus (Calc), metacarpal (Mc), metatarsal (Mt), proximal ulna (P.Ul), distal humerus (D.Hu), proximal radius (P.Ra), distal tibia (D.Ti), distal femur (D.Fe), distal ulna (D.Ul), distal radius (D.Ra), proximal femur (P.Fe), proximal tibia (P.Ti), and proximal humerus (P.Hu).*

Table 3. Excavation Data for the Gaston Dog Burials.

Burial No.	Feature No.	Bag No.	Field Documentation	Body Orientation	Associated Ceramic Type	Other Faunal Remains in Feature
1	B. 007	619b1517	yes	curled on side	Gaston, Type I Fabric, Clements	no
2A	F. 009	619b793	yes	unk.	Clements-Vincent	yes
2B	F. 009	619b793	yes	unk.	Clements-Vincent	yes
2C	F. 009	619b793	yes	unk.	Clements-Vincent	yes
X	F. 009	619b793	yes	unk.	Clements-Vincent	yes
3	F. 040	619b857	no	unk.	none	yes
4	F. 083	619b1037	no	unk.	none	no
5	F. 085	619b1040	no	unk.	none	no
6	F. 088	619b1050	no	unk.	none	no
7	F. 093	619b1066	no	unk.	none	no
8	F. 094	619b1067	no	unk.	none	no
9A	F. 102 (1103-A)	619b857	no	unk.	Vincent	yes
9B	F. 102 (1103-B)	619b857	no	unk.	none	no
10	F. 134	619b1232	yes	curled on side	none	no
11	F. 151	619b1287	yes	curled on side	none	no
12	F. 156	619b1305	no	unk.	none	yes
13	F. 161	619b1334	no	unk.	none	yes

Table 4. A Comparison of the VanDerwarker (2001) and Barkalow Analyses Concerning the Gaston Dog Burials

Context*	VanDerwarker (2001) Dog Bone Count	Barkalow (1955) Dog Bone Presence	Comment(s)
Feature 2	2		
Feature 8	18		Upon analysis, most of the dog bones (n=14) were tiny rib fragments with fresh breaks. Not substantical enough to be considered a possible dog burial in this thesis.
Feature 9	62	dog present	
Feature 19	1	dog present	
Feature 20	1	dog present	
Feature 26	1	dog present	
Feature 28		dog present	
Feature 29	3		
Feature 36	2		
Feature 40	36	dog present	
Feature 43	1		
Feature 48	1		
Feature 50	1		
Feature 55		dog present	South identifies it as a dog burial, but the skeletal remains Barkalow identified are absent from VanDerwarker's analysis and from the N.C. Archaeological Collections. Thus, this feature was omitted from my analysis.
Feature 59	5	dog present	South identifies it as a dog burial. Upon analysis, the remains present in the N.C. Archaeological Collections are too fragmentary for any meaningful analysis. Thus, this feature was omitted from my analysis.
Feature 83	76	only dog present	
Feature 85	6		South identifies it as a dog burial, but this feature was as not a part of Barkalow's analysis.
Feature 88	30		South identifies it as a dog burial, but this feature was as not a part of Barkalow's analysis.
Feature 93	78	only dog present	
Feature 94	57	only dog present	
Feature 95	1		Barkalow did not identify any dog bones in this feature.
Feature 102	354	dog present	Newly identified dog burial. South may not have identified it as dog burials because of the plethora of other species found within this feature.
Feature 105		dog present	
Feature 106	2		
Feature 134	23	only dog present	
Feature 150	176	only dog present	VanDerwarker's analysis appears to misattribute the dog bones from Feature 151 as Feature 150 based on field documentation.
Feature 151		dog present	As Barkalow identifies dogs in both Features 150 and 151, it is unknown what happened to the original Feature 150 dog bones if dog bones were found in this feature.
Feature 155	3		Barkalow did not identify any dog bones in this feature.
Feature 156	52	dog present	
Feature 161	164		Barkalow did not identify any dog bones, but did identify other fauna in the feature. VanDerwarker identified this feature as containing a dog burial. Future discussions on this feature found on page 9.
Feature 173	18		Upon analysis, most of the dog bones were small bone fragments with fresh breaks. Not substantical to be considered a possible dog burial in this thesis.
Feature 180	7	dog present	Upon analysis, most of the dog bones were small bone fragments with fresh breaks. Not substantical to be considered a possible dog burial in this thesis.
Feature 195	1		
Feature 198	1		
Feature 200	1		
Burial 7	28		This burial feature was not included in Barkalow's analysis.
Total Bone Count	1212	-	
Total Contexts	32	18	

**The dog burials at were analyzed in this thesis are in bold.*

Table 5. North Carolina Archaeological Sites with Dog Burials

Site Name	State Site No.	County	Dog Burials No.	References
Quaker Creek	31AM4	Alamance	2	Hargrove 1996; N.C. Archaeological Collection 2020
Broad Reach	31CR218	Carteret	18	Millis 2009; Lapham et al. 2015
Tillett	31DR35	Dare	1	Runquist 1984
Parker	31DV25	Davidson	unk.	Ward and Davis 1999
Gaston	31HX7	Halifax	15	South 2005; Coe 1964; Ward and Davis 1999
Liberty Hill	31HF23/24	Hertford	1	Phelps 1984
Mount Pleasant	31HF29-33	Hertford	1	Phelps 1984
Town Creek	31MG3	Montgomery	1	Coe 1995
Cape Island	31ON190	Onslow	1	Fitzgerald 2009
Pelican Point/Big Hammock	31ON235	Onslow	1	Hargrove 1996
Uniflite	31ON33	Onslow	5	Fitzgerald 2007
31ON1578	31ON1578	Onslow	1	Schaefer 2011
Flynt	31ON305	Onslow	4	Loftfield 1987
Wilson/Contenea Creek	31WL37	Wilson	21	Lapham 2001
Forbush Creek	31Yd1	Yadkin	2	Fitzgerald 2009; N.C. Archaeological Collection 2020
Donnaha	31Yd9	Yadkin	3	Woodall et al. 1984; Ward and Davis 1999

Appendix A. Osteometric Data

Table A1: Gaston Dog Crania Measurements

Measurement*	**DB 2A**	**DB 2B**	**DB 2C**	**DB 4**	**DB 5**	**DB 6**	**DB 7**	**DB 8**	**DB 9A**	**DB 9B**	**DB 11**	**DB 12**
16. Length of the molar row (M1-M2)	18.07	17.83*					27.17	16.12				
18. Length of the carnassial (P4)	16.48*		16.29*	17.35*		14.32*	17.58	15.23			16.71	17.29
18b. Greatest breadth (P4)	8.4*		8.42*	7.32*		7.42*	8.85				8.71	[8.18]
19. Length of P4								6.88				
20a. Length of first molar (M1)	11.42	11.62*	10.57*	11.78	11.2*	9.66*	11.8	11.57	12.37*	10.85*	10.9	11.87
20b. Breadth of first molar (M1)	14.43	13.8*	12.87*	14.56	13.23*	11.48*	13.99	12.14	14.04*	13.29*		13.07
21a. Length of second molar (M2)	6.37*	6.14*	6.36*	6.52			6.59	5.83		6.11	6.01	
21b. Breadth of second molar (M2)	9.73*	7.62*	8.22*	8.28			8.56	7.31		7.73	9.57	
22. Greatest diameter of the auditory bulla											21.67	
23. Greatest mastoid breadth											56.91	
24. Breadth dorsal to the external auditory meatus											54.56	
25. Greatest breadth of the occipital condyles											31.9	
26. Greatest breadth of the bases of the paraoccipital process											57.03	
27. Greatest breadth of the foramen magnum											17.21	
28. Height of the foramen magnum											15.44	
41. Height (length) of the canine											33.93	

**Denotes a measurement (in mm) taken from the right side.*

Table A2: Gaston Dog Mandible Measurements

Measurement*	DB 1	DB 2A	DB 3	DB 4	DB 5	DB 6	DB 7	DB 8	DB 9A	DB 9B	DB 10	DB 11	DB 12
8. Length of the cheektooth row, P1-M3								58.25				65.59	
9. Length of the cheektooth row, P2-M3								54.48			58.79	60.77	61.99
10. Length of the molar row, M1-M3								28.85		32.69	29.27	31.13	31.06
11. Length of the premolar row, P1-P4							33.86*					34.95	
12. Length of the premolar row, P2-P4	28.2*				29.08		30.21*	27.15		31.39	28.87	30.19	31.81
13a. Length of carnassial (M1)	18.42	18.72		19.72*	18.51	16.52	20.19*	17.62	20.4*	19.62*	[16.86]	17.89	19.15
13b. Breadth of carnassial (M1)	7.35	7.57		7.54*	7.46	6.69	8.16*	7.25	8.14*	7.35*	7.09	7.39	7.49
14. Length of the carnassial (M1) alveolus	19.18	19.3		22.28*	[19.43]	17.01	19.62*	17.63			17.19	17.52	18.53
15a. Length of M2	[6.85]	8.11				6.67		7.42		8.07	7.31	7.95	7.4
15b. Breadth of M2	[5.46]	6.24				5.55		5.4		5.71	5.73	6.29	6.21
16a. Length of M3					4.33*		4.2*	3.83					
16b. Breadth of M3					3.96*		4.1*	3.37					
17. Greatest thickness of the mandible body		8.62		10.36*	9.58		10.02*	9.28		9.15		9.86	10.89
18. Height of the vertical ramus			52.53									46.7	
19. Height of the mandible behind M1		18.19		21.53*	19.83		21.23*	19.43		18.73		20.75	20.68
20. Height of the mandible between P2 and P3				17.5*	15.91			15.21		15.63		16.13	17.62
21. Height (length) of the canine				33.08			32.33*	30.48			31.93		

**Denotes a measurement (in mm) taken from the right side.*

Table A3. Gaston Dog Axis (C-1) Measurements

Measurement*	DB 11
1. Greatest breadth over the wings	30.17
2. Greatest length	25.5
3. Greatest length from the facies articularis cranialis	30.1
to the facies articularis caudalis	17.37
4. Greatest breadth of the facies articularis caudalis	14.15
5. Breadth of the caudal channel	22.6
6. Height of the caudal channel	26.38
7. Height of ventral arch	10.4

**Measurements are in mm.*

Table A4. Gaston Dog Atlas (C-2) Vertebra Measurements

Measurement	DB 6	DB 11
1. Greatest length in the region of the corpus including the dens		41.29
3. Greatest length of the arch		32.02
4. Breadth of the facies articularis cranialis	21	43.36
5. Breath of dens	5.95	25.47
6. Breadth of the cranial channel		7.1
7. Smallest breath of the vertebra		10.6
8. Greatest height		17.8
9. Greatest breadth of the facies terminalis caudalis		32.72
10. Breadth across the processus transversi caudalis		14.74
11. Breadth across the processus articulares caudales		23.05

** Measurements are in mm.*

Table A5. Gaston Dog Scapula Measurements

Measurement	DB 9A	DB 11	DB 12	DB 13	DB X
1. Greatest length of the processus articularis		24.68	23.63	22.85	24.6
2. Length of the glenoid cavity		20.88*	20.52*	20.54*	19.49*
3. Breadth of the glenoid cavity		14.47*	13.42*	13.62*	14.16*
4. Smallest length of the collum scapulae	15.96	21.2*		16.9*	
5. Height of spine		107.12*			
6. Diagonal height from the most distal point of the scapula to the thoracic angle		98.37*			

**Denotes a measurement (in mm) taken from the right side.*

Table A6. Gaston Dog Humerus Measurements

Measurement	DB 9A	DB 9B	DB 11	DB 12	DB 13	DB X	DB X
1. Depth of the proximal end			34.13		28.61		
2. Smallest breadth of the diaphysis	7.95	7.96*	9	9.96*	9.45*	9.47	9.76*
3. Breadth of the distal end		26.11*	26.9	25.5*	24.36*		26.8*
4. Breadth of the trochlea		20.44*	18.4	17.76*	19.27*		[19.62]*
5. Depth of distal end		20.33*	20.31	20.27*	18.93*		19.74*
6. Height of distal end		14.7*	15.48	14*	17.27*		16.01*
7. Greatest length			134.42				
8. Greatest length without epiphyses	79.26						

**Denotes a measurement (in mm) taken from the right side.*

Table A7. Gaston Dog Ulna Measurements

Measurement*	DB 3	DB 7	DB 9A	DB 9B	DB 11	DB 12	DB 13	DB X	DB X
1. Breadth across the coronoid process	12.9	12.61	12.74		14.2*	[13.49]*	10.96*	12.7*	13.37
2. Depth of the processus anconaeus				[18.77]*	20.1*	19.78*	18.31*		18.64
3. Smallest depth of the olecranon				15.29*	17.24*	17.25*	15.23*		17.17
4. Greatest length					164.71*				

**Denotes a measurement (in mm) taken from the right side.*

Table A8. Gaston Dog Radius Measurements

Measurement*	DB 3	DB 9A	DB 9B	DB 10	DB 11	DB 12	DB X	DB X	DB X
1. Breadth of the proximal end		13.08			15.16	14.63*	14.18		
2. Breadth of the facies articularis proximalis		12.82			13.34	13.1*	12.95		[12.5]*
3. Smallest breadth of the diaphysis	10.91*	7.6	8.14	9.86	9.04			9.96*	10.02*
4. Breadth of the distal end	20.32*				20.21				
5. Breadth of the facies articularis distalis					15.57				
6. Depth of distal shaft					11				
7. Greatest length					[136.75]				

**Denotes a measurement (in mm) taken from the right side.*

Table A9. Gaston Dog Pelvis Measurements

Measurement*	DB 11	DB 13
1. Length of the acetabulum	18.34	15.96
2. Breadth of acetabulum	20.83	18.92
4. Thickness of the acetabulum		9.49
9. Smallest height of the ilium shaft	13.81	
10. Smallest breadth of ilium shaft	7.24	

**Denotes a measurement (in mm) taken from the right side.*

Table A10. Gaston Dog Sacrum Measurements

Measurement*	DB 11	DB X
1. Greatest breadth (across the wings)	37.4	
2. Breadth of the cranial articular surface	18.1	
3. Height of the cranial articular surface	9.04	9.12
4. Physiological length	28.8	
5. Greatest length of the ventral side	[35.01]	

**Measurements are in mm.*

Table A11. Gaston Dog Femur Measurements

Measurement*	DB 3	DB 6	DB 7	DB 9A	DB 9B	DB 11	DB 13	DB X	DB X	DB X	DB X
1. Breadth of the proximal end	35.81*					31.89	30.64		29.88		
2. Breadth of the trochanter tertius	19.68*		[19.00]*	22.85	19.37				17.73		
3. Depth of the caput femoris	16.82*			11.84		14.63	13.67		14.84		
4. Smallest breadth of the diaphysis	12.34*	8.8*	9.4	8.47	8.9*	10	10.11	10.44	10.5	9.88	9.38
5. Breadth of the distal end	28.45			22.62		25.33	23.85*				
6. Greatest length				95.74	[131.95]*						
7. Greatest length without epiphyses				85.02	122.59*						

**Denotes a measurement (in mm) taken from the right side.*

Table A12. Gaston Dog Tibia Measurements

Measurement*	DB 9A	DB 9B	DB 11	DB 13	DB X	DB X
1. Breadth of the proximal end	22.25*	27.47	28.13*	27.79		
2. Smallest breadth of the diaphysis		8.25	10.08*	9.06	9.86	10.62*
3. Breadth of the distal end		[18.87]	18.55*			
4. Breadth of the facies articularis distalis			14.47*			14.94*
5. Depth of the medial distal end		13.19	13.01*			
6. Depth of the lateral distal end			9.27*			
7. Greatest length						145.75*
9. Greatest length without epiphyses		[119.63]				

**Denotes a measurement (in mm) taken from the right side.*

Table A13. Gaston Dog Astragalus Measurements

Measurement*	DB 9A	DB 9B	DB 11	DB 13
1. Depth of distal end	8.99	[9.59]	11.47*	14.72
2. Deapth of the medial half	14.49	10.29	14.33*	13.17
3. Breadth of proximal end		10.42		
5. Greatest length	21.56	20.9	22.19*	19.61
6. Greatest length of the medial half		13.25		

** Denotes a measurement (in mm) taken from the right side.*

Table A14. Gaston Dog Calcaneus Measurements

Measurement*	**DB 3**	**DB 9A**	**DB 9B**	**DB 10**	**DB 11**	**DB 12**
1. Depth laterally	15.12*	13.13	11.1	12.48	15.67	12.79*
2. Greatest breadth	16.98*		13.61	15.15	15.61	15.18*
3. Greatest length	41.21*			35	38.62	35.42*
4. Greatest length without epiphyses			29.13			

** Denotes a measurement (in mm) taken from the right side.*

Appendix B. Radiocarbon Dating Results

DirectAMS
RADIOCARBON DATING SERVICE
measure more, learn more.

Report: **2360-037301-037302** 9 March 2020

Customer: 2360
Mary Glenn Krause
University of North Carolina
Research Laboratories of Archaeology
108 Alumni Building
Chapel Hill, NC 27599
USA

Samples submitted for radiocarbon dating have been processed and measured by AMS. The following results were obtained:

DirectAMS code	Submitter ID	Sample type	Fraction of modern		Radiocarbon age	
			pMC	1σ error	BP	1σ error
D-AMS 037301	DB-12	bone (collagen)	92.34	0.29	640	25
D-AMS 037302	DB-14	bone (collagen)	87.83	0.26	1042	24

Results are presented in units of percent modern carbon (pMC) and the uncalibrated radiocarbon age before present (BP). All results have been corrected for isotopic fractionation with an unreported $\delta^{13}C$ value measured on the prepared carbon by the accelerator. The pMC reported requires no further correction for fractionation.

11822 North Creek Parkway N, Suite #107, Bothell, WA 98011
Tel (425) 481-8122 – www.DirectAMS.com