# A Baumer Phase Dog Burial from the Kincaid Site in Southern Illinois

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*Recent excavations at the Kincaid site in southern Illinois uncovered a small domestic dog (Canis familiaris) buried in a Baumer phase pit from the Early to Middle Woodland transition (ca. 250 B.C. to A.D. 1). This article describes the skeleton and burial in greater detail, explores the prevalence of dog burials in the study region, and compares the size of the dog with other southeastern canines. The study concludes that dog burials are rare finds on archaeological sites in southern Illinois during the Woodland period as well as earlier and later in time. The Kincaid dog is also unique in its small size, which may explain some of the dental abnormalities observed.*

The relationship between humans and dogs in prehistory has long intrigued archaeologists, perhaps because of the special place dogs hold in our lives today as beloved and loyal companions. Dogs have earned their reputation as friends, guardians, helpers, and heroes time and time again through selfless acts that we often interpret as unconditional love. The relationship between dogs and their owners today is not the topic of this article, however; rather, it is the question of past human and canid relationships, or least what can be gleaned about this topic from the study of one domestic dog laid to rest more than 2,000 years ago at the Kincaid site in southern Illinois.

Domestic dogs (*Canis familiaris*) descended from gray wolves (*C. lupus*), arriving in North America alongside their human companions as they crossed the Bering Strait from Asia and colonized the New World (Clutton-Brock 1995; Olsen 1974; Schwartz 1997). Recent comparative genetic research has shed light on the origins and evolutionary history of these canids in the Eurasian continent (Savolainen et al. 2002; Verginelli et al. 2005; Vilà et al. 1997). Some studies also suggest an independent domestication event occurred in the Americas (Koop and Crockford 2000), although other research contradicts this interpretation (Leonard et al. 2002; Vilà et al 1999). Behavioral, physiological, and morphological changes accompanied domestication; the latter include an overall reduction in body size, a wider cranium and steeper forehead, a shortening of

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the muzzle region, and crowding of the teeth (Clutton-Brock 1963, 1984; Morey 1986, 1994a; Olsen 1985). These patterns are consistent with paedomorphosis, the lifelong retention of juvenile traits, which occurs in dogs as well as other domestic animals and is linked to juvenile behavioral characteristics such as playfulness, docility, and submissiveness (Morey 1994a; Zeder 2006).

Dogs were the only domestic animal in the American Southeast, where they served as hunters, guardians, pack animals, and human companions as well as the occasional meal and ritual offering (Morey 2006; Schwartz 1997, 2000). The intentional burial of dogs speaks to the special status they held in the lives of prehistoric peoples. Dog burials are found on Archaic, Woodland, Mississippian, and Historic period sites in the Southeast (Breitburg 1982; Darwent and Gilliland 2001; Hogue 2006; Lewis and Lewis 1961; MacCord and Buchanan 1980; McMillan 1970; Morey 1994b; Parmalee 1959; Parmalee and Bogan 1978; Pavao-Zuckerman 2001, 2007; Walker et al. 2005; Warren 2000; Webb 1946, 1950a, 1950b; Webb and Dejarnette 1942; Webb and Hagg 1939, 1947; Weisman 1992). The earliest well-documented dog burials in Illinois date to about 8,500 years ago at the Koster site in the Illinois River Valley, where archaeologists found three dogs carefully placed in shallow graves (Morey and Wiant 1992). The focus of this article is a dog buried much later in time, during the Early to Middle Woodland transition, in southern Illinois. In the following sections, I describe the skeleton and burial, explore the occurrence of dog burials in the study region, and compare the size of the Baumer phase dog from the Kincaid site with other southeastern canines.

## The Baumer Phase Dog Burial

The Kincaid site is located along Avery Lake on a large floodplain of the Ohio River in present-day Massac and Pope counties in southern Illinois (Figure 1). Designated a National Historic Landmark in 1964, the site is best known for its extensive Mississippian (ca. A.D.1000–1500) occupation that at its peak extended for more than 1.5 km along the lake, encompassing about 60 ha. Five main platform mounds and several smaller mounds encircle a large central plaza area, with numerous small mounds extending to the east and west along with associated plazas and habitation areas (Figure 2) (Butler and Welch 2005; Cole et al. 1951). Excavations at Kincaid have also produced evidence of a sizeable Early to Middle Woodland occupation preserved beneath Mississippian cultural deposits (Butler 2006; Butler and Welch 2003; Cole et al. 1951). The prevalence of limestone-tempered ceramics identify this Woodland occupation as Baumer phase, which is a local expression of the Crab Orchard tradition that stretched across southern Illinois and into adjacent areas along the Mississippi, Ohio, and Wabash rivers in southeastern Missouri, western Kentucky, and southwestern Indiana during the Early Woodland (B.C. 600–150) and Middle Woodland (B.C. 150–A.D. 400) periods (Butler and Jefferies 1986).

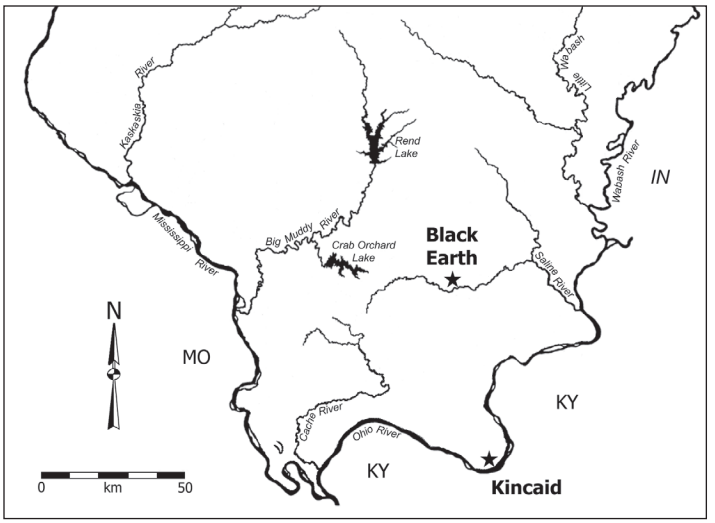


***Figure 1. Map of southern Illinois with the Kincaid and Black Earth sites located.***

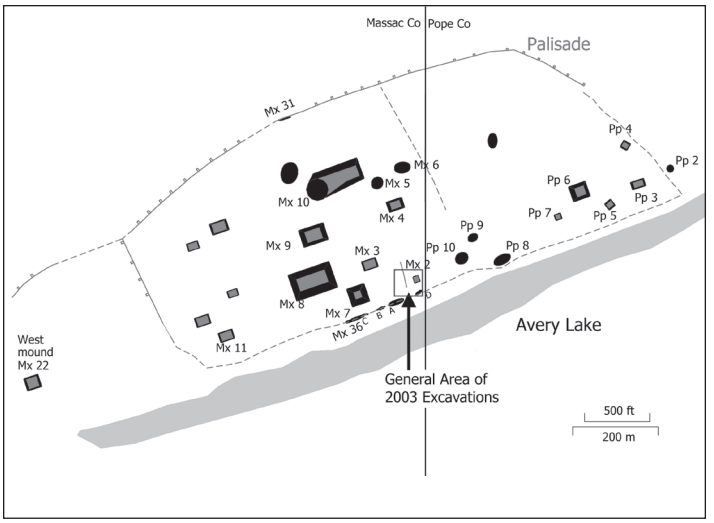


***Figure 2. Map of the Kincaid site (Illustration credit: Paul D. Welch).***

In July and August 2003, the Center for Archaeological Investigations at Southern Illinois University–Carbondale conducted excavations on the state-owned portion of the Kincaid site in Massac County (see Figure 2). The excavations were undertaken to assess the archaeological significance of an area in the southeast corner of the main plaza where the Kincaid Mounds Support Organization had proposed to build a small parking lot and overlook for visitors (Butler 2006; Butler and Welch 2003, 2005). Five 1-x-2-m test units were excavated, which revealed ten prehistoric features including six pit features associated with the Baumer phase. The skeletal remains of a domestic dog (*Canis familiaris*) were discovered buried in the fill above the bottom of a shallow, flat-bottomed, Baumer storage pit designated Feature 7. Feature 7 was identified in unit 97E 98N at the base of Baumer phase midden (Zone III), which underlays Mississippian mound construction fill (Zone II) (Figure 3) (Butler and Welch 2003, 2005). It is a bell-shaped, cylindrical pit, measuring about 90 cm in diameter and 40 cm in depth. Besides the dog burial, Feature 7 contained only a few artifacts, including a small assemblage of limestone-tempered ceramic sherds and a handful of lithic debitage. None of these artifacts were directly associated with the burial. Feature 7 is not directly dated, but based on the ceramic assemblage and radiocarbon dates from other features, the most

likely time range is ca. 250 B.C. to A.D. 1, which spans the Early Woodland to Middle Woodland transition (Brian Butler, personal communication 2010).

The Baumer phase dog in Feature 7 was buried lying in a curled position on its left side with its cranium oriented toward the north and its line of vision facing eastward (Figure 4a). The skull and mandibles had long ago been compressed by the surrounding fill settling in the pit. Although the bones were adequately preserved, their removal was greatly hindered by the surrounding clayey fill that made excavation an extremely tricky task. Skeletal elements were identified in situ when possible, pedestaled for photographs, and then carefully removed and bagged by body part. Additional identifications of some of the smaller bones and bone fragments were made in the Center for Archaeological Investigation's Zooarchaeology Laboratory. Using a modern dog skeleton articulated in sand, the burial was further reconstructed and drawn. The drawing was then digitally superimposed over an original photograph of the burial (Figure 4b). This image better illustrates the dog's position in the pit than do the in situ photographs in which clay-covered bones and the surrounding feature fill blend together too harmoniously. The drawing illustrates the cranium and vertebra column, forelimbs, hindlimbs, and forefeet. Some of the more obvious elements missing in this drawing are the pelvis and hindfeet, which were removed in fragments prior to the excavation of the burial.

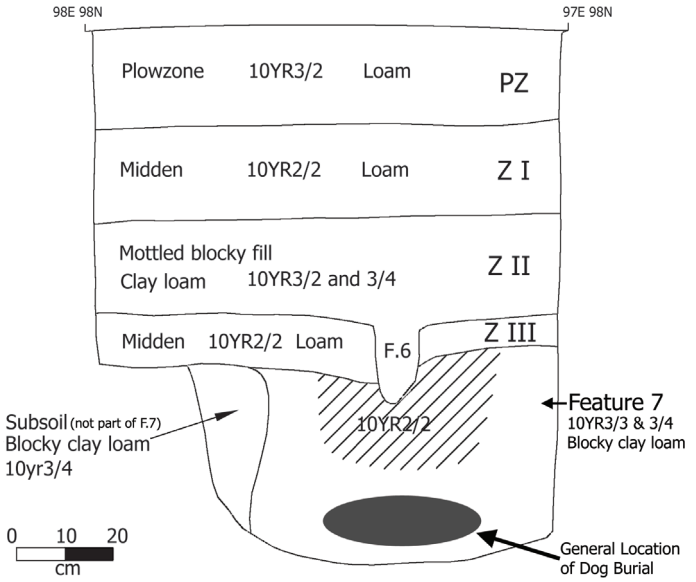


***Figure 3. Profile of the south wall of unit 97E 98N (Illustration credit: Paul D. Welch).***

Analysis of the skeletal remains indicates the dog is an adult animal, based on the complete fusion of all of the long bones (cf., Silver 1969; Sumner-Smith 1966). The lower first molars exhibit slight to moderate wear on the occlusal surfaces, which suggests a middle-aged adult dog (Stage D in Horard-Herbin 2000; see also Warren 2004:39–40). The absence of a baculum suggests this dog is female; unfortunately, the pelvis is too fragmented to confirm the sex (cf., Shigehara et al.1997). No pathologies were noted on the postcranial skeleton; however many of the areas where pathologies are typically

observed (cf., Darwent and Gilliland 2001:154; Walker at al. 2005:88; Warren 2000, 2004) were very fragmented.

Most dogs have 42 permanent teeth. The maxilla has three incisors($I^{1-3}$), one canine ($C^{1}$), four premolars ($P^{1-4}$), and two molars ($M^{1-2}$) on each side, and the mandible has

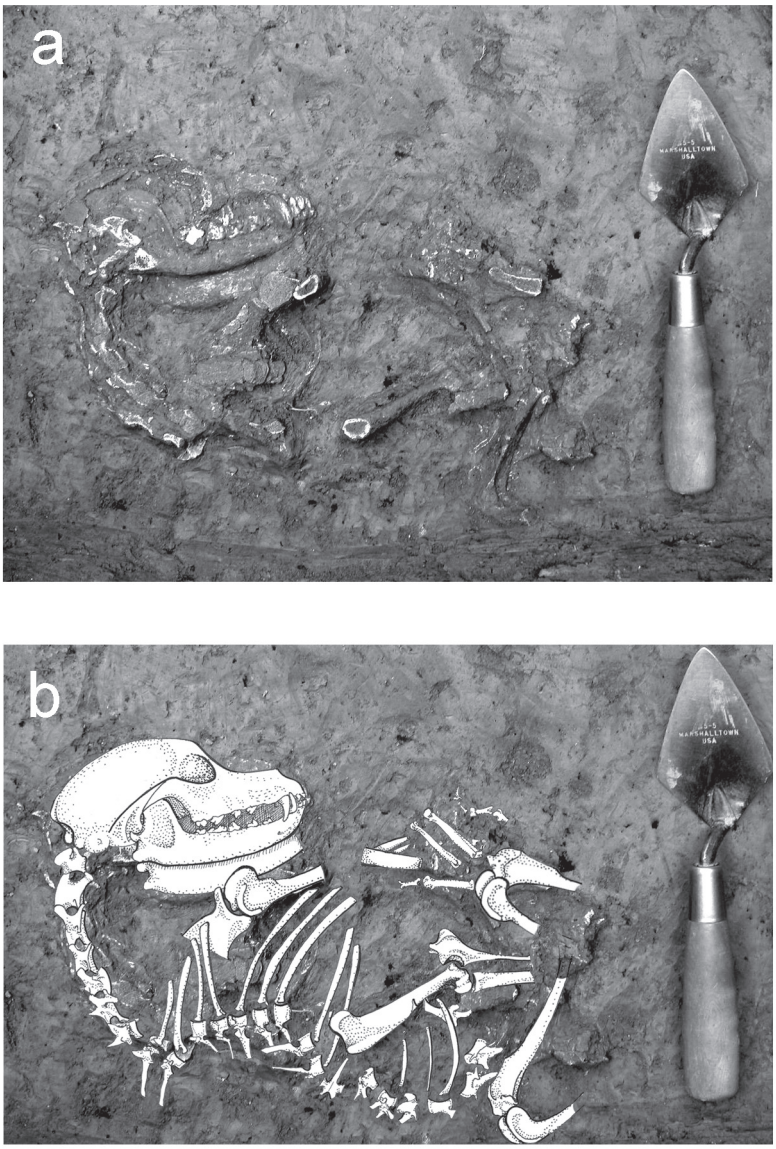


***Figure 4. Photograph of the Baumer phase dog burial from the Kincaid site (a) in situ and (b) with a drawing superimposed over it (Illustration credit: Rachel Pepper).***

three incisors ($I_{1-3}$), one canine ($C_1$), four premolars ($P_{1-4}$), and three molars ($M_{1-3}$) per side. In the Baumer phase dog, the right and left first premolar teeth in the upper ($P^1$) and lower ($P_1$) jaw are absent. These four teeth appear never to have been present. The small size of the jaws and the lack of space where the premolar teeth should have been suggests their absence is congenital. It is possible, however, that the teeth were lost sometime earlier in the dog's life and that the alveolar remodeling was so complete that the absence appears to be congenital or that the teeth were impacted and thus never erupted (see Hillson 2005:281). Antemortem tooth absence of the lower first premolars is not uncommon in prehistoric North American dog populations, and sometimes this anomaly occurs quite frequently (Allen 1920; Colton 1970; Crockford 1997; Parmalee and Bogan 1978; Warren 2004). In a recent study of the palaeopathology of domestic dogs from the prehistoric Southeast, Warren (2004:Table 8.3) found this tooth to be absent in an average of half (49%) of the dogs ($n$ = 55) she examined from Woodland sites in central Illinois, southern Tennessee, and northern Alabama. The upper first premolar was absent in about two-fifths (38%) of the dogs ($n$ = 48) from this sample (Warren 2004:Table 8.3). These percentages consider general antemortem tooth absences that may have been due to a tooth that failed to develop, a tooth that was not visible because it was impacted, and a tooth an animal lost in life. The estimated maximum frequencies of congenital tooth absence were lower, 42 percent for the lower first premolar and 23 percent for the upper first premolar of the dogs studied ($n$ = 55 and 48, respectively) (Warren 2004:Table 8.5).

In addition to missing its first premolar teeth ($P^1$ and $P_1$), the Baumer phase dog is also missing a molar in the right and left mandible. In domestic canids, the lower third molar ($M_3$) is often vestigial, but absence rates for this tooth tend to be low in prehistoric North American dog populations (Crockford 1997:38; Warren 2004:Table 8.3). The mandibular molar teeth of the Baumer phase dog are even more unusual. The absent tooth in the left mandible is the third molar ($M_3$) (Figure 5b), which is not unexpected given what is known about prehistoric dog dentition. In the right mandible, however, the absent tooth is a second molar ($M_2$), leaving the third molar to follow the first molar in sequence (Figure 5a). This dental anomaly is verified by distinct differences in the size, shape, and morphology of the final mandibular teeth. These final molars exhibit very heavy wear, being worn down almost to the root on the right third molar and close to it on the left second

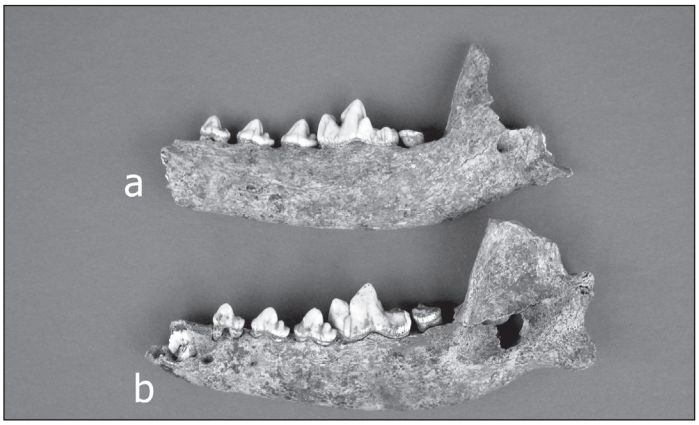


***Figure 5. Baumer phase dog mandibles, (a) right and (b) left sides.***

molar. These teeth exhibit substantially greater wear than do the adjacent first molars, which show slight to moderate wear on the occlusal surfaces. Whatever it ate, this dog used its teeth more intensely for crushing than tearing and cutting (see Olsen 1985:6).

Two other aspects of the Baumer phase dog burial are of interest. First, dog burials are uncommon in the archaeological record of southern Illinois, and second, the dog itself is unusually small in size. These two factors are explored further in the remainder of this article.

## Woodland Dogs in Southern Illinois

The intentional burial of domestic dogs is a common phenomenon north of the study region in central Illinois during the Middle Woodland period. More than two dozen dog burials, some quite elaborate, have been recovered from at least 13 Havana tradition (B.C. 200–A.D. 400) sites in the lower Illinois River valley (Cantwell 1980). Were dog burials also common in southern Illinois during the Woodland period? Research to answer this question led to the realization that Crab Orchard faunal assemblages are few and far between. As noted earlier, the Baumer phase is a local expression of the Crab Orchard tradition that encompassed much of southern Illinois during the Early and Middle Woodland periods.

Although numerous Crab Orchard sites have been identified since Maxwell described the tradition in his 1951 publication titled *Woodland Cultures of Southern Illinois*, the recovery of well-preserved animal remains associated with Crab Orchard occupations has occurred much less frequently. The overall paucity of Crab Orchard fauna is due to several factors. First, few Crab Orchard sites have been extensively excavated; rather, many sites have been located through archaeological surveys and preliminary testing (Craig and McNerney 1990; McNerney 1975; Pauketat et al. 1984; Pulcher and Rogers 1987; Stephens 1991), and surveys rarely produce fauna in any significant quantity. Second, Crab Orchard sites are often identified by isolated pit features located within multicomponent sites rather than by a single, intensively occupied area (Butler and McGimsey 2000; Denny 1970; Wagner and Butler 1999; Wagner and McCorvie 1986; Wagner et al. 1992), so faunal assemblages when recovered tend to be small (Breitburg 1999; Cremin 1975; Falk and Klippel 1987; Hargrave et al. 1991; Hargrave et al. 1992; Hill 1975; Kelly 1986; Wagner 1992). And, third, bone preservation in southern Illinois can be poor, and this is especially true for remains that are thousands of years old.

Beyond the Kincaid dog burial, other examples of the intentional interment of domestic dogs during the Woodland period in southern Illinois are found at the Black Earth site (11SA87) located within the Carrier Mills Archaeological District in Saline County, Illinois. At least four dog burials were identified during the extensive excavations of this large, complex, multicomponent site (Jefferies 1982:Table 28). Area A of the Black Earth site contains a major late Middle Archaic (cal. B.C. 4130–3660) occupation represented by deep midden deposits along with features associated with both the Middle and Late Woodland periods. The four dog burials (Features 73, 186, 198,

and 290) come from features that can only be assigned to the general Woodland period because their artifact assemblages contain too few ceramics to allow cultural association to be ascertained, but their point of origin, or depth of recognition, falls within the Woodland occupation periods (Jefferies 1982:136). In this area of the site, however, Middle Woodland features ($n$ = 118) outnumber Late Woodland features ($n$ = 6) almost 20 to 1 (see Jefferies 1982:Table 22). Although it is possible that the dog burials date to the Late Woodland period, it is more likely based on feature frequency that they are associated with the Middle Woodland Crab Orchard occupation at the Black Earth site.

Only one of the four dog burials was preserved well enough to allow for comprehensive in situ documentation. This dog (Feature 198) was buried lying on its right side in a tightly curled position with its cranium oriented toward the northeast and its line of vision facing northwest (Figure 6). The field notes make no mention of associated artifacts. Breitburg's (1982:903–904) analysis of the remains indicate this was a mature animal of indeterminate sex. Based on a reexamination of wear patterns on the occlusal surfaces of the posterior dentition, this was an older adult animal with teeth that show moderate to heavy wear (Stage G-a in Horard-Herbin 2000). Field notes for the other dog burials at the Black Earth site sketch only partial skeletons for which burial position could not be determined. These animals (Features 186 and 290) include two subadults between 6–8 months of age for which mandibles were not recovered so age estimates are based on degree of fusion following Sumner-Smith (1966). The fourth dog burial


***Figure 6. Feature 198 dog burial from the Black Earth site (Photograph on file at the Center for Archaeological Investigations, Southern Illinois University–Carbondale).***

(Feature 73) was a middle-aged adult dog with teeth that show slight to moderate wear (Stage E in Horard-Herbin 2000).

In addition to the four dog burials, excavations at the Black Earth site also yielded 11 isolated skeletal elements positively identified as domestic dog (*Canis familiaris*) and

another 24 specimens identified to the Canidae family (*Canis* spp.) from feature contexts associated with the Middle Woodland Crab Orchard component (Breitburg 1982:Table 274). The Canidae family includes foxes, dogs, coyotes, and wolves. Another five specimens identified to the Canidae family were recovered from Middle Woodland features at a site adjacent to Black Earth, 11SA88 (Bloom 1982). Breitburg (1982:904) argues that the absence of butchery scars on the bones provides evidence that these animals were not being consumed by the site inhabitants; however the number of dog elements identified in the faunal assemblage suggests otherwise. Domestic dog ranks as the sixth most frequently identified mammalian species during the Middle Woodland period; in terms of the number of identified specimens (NISP), dog is preceded by white-tailed deer (*Odocoileus virginianus*), squirrel (*Sciurus carolinensis* and *S. niger*), raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), and muskrat (*Ondatra zibethicus*) (Breitburg 1982:Table 274). It is quite possible that dogs were occasionally eaten at the Black Earth site, but that the way they were processed, cooked, and consumed provided few opportunities to scar the bone, hence the absence of cut marks. Certain cooking techniques, such as roasting, required minimal butchery (Kent 1993:337; Snyder 1991:366–367).

Domestic dog has yet to be positively identified at other Crab Orchard sites in southern Illinois. At the Little Muddy Rockshelter (11J814) in Jackson County, the Crab Orchard component yielded four Canidae bones (*Canis* spp.), so it is possible that domestic dog is represented here, but it is also just as likely that these bones belonged to coyote or possibly wolf (Martin 1991; Martin and Masulis 1992). Dog remains have not been identified in other Baumer phase features from the Kincaid site (Gilmore 2006), although excavations by the Center for Archaeological Investigations in conjunction with the Department of Anthropology at Southern Illinois University–Carbondale are ongoing and may yield domestic canines in the future. During the Late Woodland period in southern Illinois, Canidae remains are found in small numbers (Bloom 1982; Lapham 2008).

Dog burials are uncommon features on Woodland sites in southern Illinois, and few examples exist in the region for earlier Archaic or later Mississippian time periods. Middle Archaic components at the Black Earth site in southern Illinois contained one or more dog burials (described as Dog Burial 3 and a "fourth deposit of dog bones" in Breitburg 1982:904). Excavations at the Modoc Rock Shelter site in Randolph County uncovered two dog burials from Archaic period components (Parmalee 1959:63). Reyman (1971:25) identified a possible dog buried alongside a human infant in a probable Archaic component at the Peter's Cave site (24B1-1) in Jackson County, Illinois. Analysis of these materials by Parmalee (1971) identified only 11 elements (10 rib fragments and a thoracic vertebra) as possibly belonging to domestic dog. Whether or not these remains actually represent a dog burial is uncertain. Further north outside of the study region in western Illinois, Early Archaic components at the deeply stratified, multicomponent Koster site in Greene County yielded some of the earliest documented dog burials in North America, dated to around 8,500 years ago (Morey and Wiant 1992).

Later in time, during the Mississippian period, isolated finds of disarticulated dog elements are encountered more often than whole interments, at least within the immediate study region of southern Illinois. Small numbers of dog bones have been identified in general refuse contexts at the Petitt site (11AX253) (Breitburg 1992) and from village areas ($Mx^{v}1A$ and $Mx^{v}1D$) associated with the Mississippian occupation at the Kincaid site (Buchanan 2003; Neumann 1935). No dog burials have been identified in Mississippian contexts at either locale, although investigations at Kincaid are ongoing and future excavations could yield a canine interment.

## Metric Comparisons of Southeastern Dogs

Another interesting aspect of the Kincaid dog burial is that the dog itself is unusually small in size. An initial comparison of select skeletal elements of the dog with domestic and wild canids housed in the Zooarchaeology Laboratory at the Illinois State Museum suggests the animal was about the size of a fox terrier—a modern breed that stands about 40 cm tall at shoulder height and weighs between 7 and 8 kilos (American Kennel Club breed standards). To determine if the Kincaid dog was uncommonly small, several cranial and postcranial measurements are compared with dog skeletons recovered from other southeastern archaeological sites.

Only one postcranial element from the Kincaid dog, the right calcaneus, was complete enough to measure. These same measurements were also taken on the left calcanei of the Feature 198 dog burial from the Woodland occupation at the Black Earth site. The lengths of the two calcanei measured 33.20 mm and 39.14 mm, with greatest breadth measuring 13.87 mm and 15.71 mm (Tables 1 and 2). The Kincaid dog is substantially smaller than the Black Earth dog based on the size of this foot bone.

Cranial measurements are largely limited to the mandibular body and dentition due to preservation of the Kincaid dog (Tables 1 and 2). Traditional canid dentition measurements as defined by von den Driesch (1976), Hagg (1948), and Lawrence (Meadow 2000) could not be used here because it is missing its lower first premolars and final molars. Instead, the author measured the total length of the third and fourth premolars and the first molar at the aveolus (Tables 1 and 2). Figure 7 graphs this measurement against the thickness of the mandibular body. Only two of the four dog burials (Features 73 and 198) from the Woodland component at the Black Earth site could be measured (mandibles were not recovered from the other two burials). The Kincaid dog is still the smallest animal, although two specimens are not an adequate comparative sample. These same measurements were then taken on three dog mandibles recovered from Archaic period stratum at the Black Earth site. Two right mandibles were recovered from level 7 in unit N267 E66 and one right mandible from level 8 in unit N276 E60 (Table 2). The mandibles from unit N267 E66 were found in the level above Breitburg's (1982:904) Dog Burial 3, and one of the two mandibles (although which one is uncertain) likely belongs with the burial. All three mandibles exhibit moderate to heavy wear, indicating

these dogs were older adult animals. The measurements from the Kincaid dog are by far the smallest within this limited sample of southern Illinois dogs.

Additional comparative measurements were then compiled from previous research by Darwent et al. (2001), Haag (1948), McMillian (1970), Morey (1994b), Parmalee

***Table 1. Metric Data for the Baumer Phase Dog from the Kincaid Site.***

| Measured Element | Right | Left |
|---|---|---|
| **Maxilla** | | |
| 16. Length of $M^1$-$M^2$ | – | 15.25 |
| 18. Length of carnassial ($P^4$) | – | 15.52 |
| Breadth of carnassial ($P^4$) | – | 5.65 |
| 18a. Greatest breadth of carnassial ($P^4$) | – | 7.38 |
| 19. Length of carnassial ($P^4$) alveolus | – | 14.3 |
| 20. Length of first molar ($M^1$) | – | 11.58 |
| Breadth of first molar ($M^1$) | – | 12.94 |
| 21. Length of second molar ($M^2$) | 5.95 | 5.64 |
| Breadth of second molar ($M^2$) | 7.95 | 7.46 |
| **Mandible** | | |
| – Length of $P_3$-$M_1$ | 34.57 | 34.48 |
| 12. Length of $P_2$-$P_4$ | 25.9 | 25.59 |
| 13. Length of carnassial ($M_1$) | 17.32 | 17.39 |
| Breadth of carnassial ($M_1$) | 7.7 | 7.14 |
| 14. Length of carnassial ($M_1$) alveolus | 17.02 | 17.01 |
| 15. Length of second molar ($M_2$) | – | 6.15 |
| Breadth of second molar ($M_2$) | – | 4.93 |
| 16. Length of third molar ($M_2$) | 5.36 | – |
| Breadth of third molar ($M_2$) | 4.43 | – |
| 17. Thickness of jaw body below $M_1$ | 8.26 | 8.24 |
| 19. Height of mandible behind $M_1$ | 16.94 | 16.98 |
| 20. Height of mandible between $P_2$-$P_3$ | 14.87 | 14.73 |
| **Calcaneus** | | |
| 1. Greatest length | 33.2 | – |
| 2. Greatest breadth | 13.87 | – |

Note: Measurements (in mm) follow von den Driesch (1976), except length of $P_3$–$M_1$.

***Table 2. Comparative Metric Data from the Black Earth Site.***

| Measured Element | Woodland | | Archaic | | |
|---|---|---|---|---|---|
| | Feature 73 | Feature 198 | N267 E66 | | N276 E60 |
| **Mandible** | | | | | |
| – Length of $P_3$-$M_1$ | 41.45 | 40.46 | 43.63 | 47.13 | 38.5 |
| 13. Length of carnassial ($M_1$) | 18.9 | 18.89 | 19.5 | 21.3 | 17.4 |
| 17. Thickness of jaw body below $M_1$ | 9.92 | 10.89 | 10.53 | 10.14 | 9.25 |
| **Calcaneus** | | | | | |
| 1. Greatest length | – | 39.14 | – | – | – |
| 2. Greatest breadth | – | 15.71 | – | – | – |

Note: Measurements (in mm) follow von den Driesch (1976), except length of $P_3$-$M_1$.

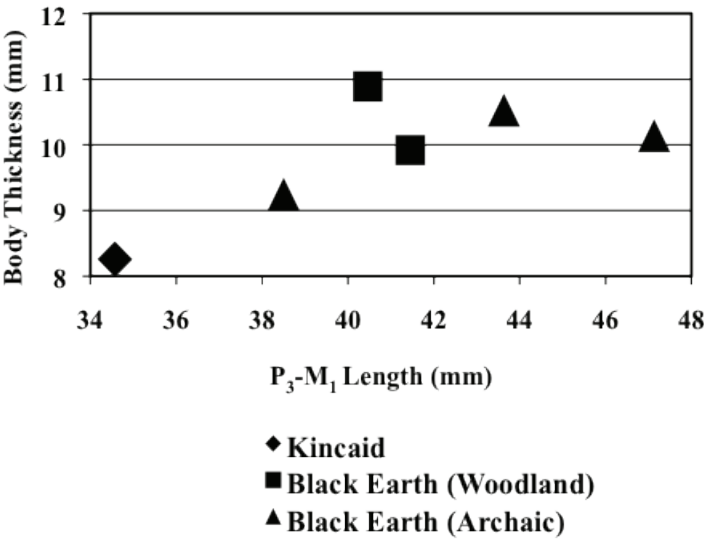


***Figure 7. Comparison of mandibular metrics between the Kincaid and Black Earth dogs.***

and Bogan (1978), and Walker et al. (2005). Because of the fragmented condition of the skull and the absence of the last lower molar in the Kincaid dog, only one (number 32) of the 44 cranial and postcranial measurements proposed by Hagg (1948) in his seminal publication "An Osteometric Analysis of Some Aboriginal Dogs" could be used to obtain a larger comparative sample of southeastern dogs (Table 3). Hagg's measurement number 32 (1948:115), which is the same as von den Driesch's *Canis* mandible measurement number 13 (1976:61), measures the length of the lower carnassial tooth (i.e., the first mandibular molar). Carnassial length of the Kincaid and Black Earth dogs is compared to 12 dogs from 8 Woodland sites in central Illinois, southern Missouri, Kentucky, and northern Alabama (Table 3). These data are graphed in Figure 8. The Kincaid dog is represented by a star symbol, the Black Earth dogs by the squares, and the rest of the Woodland dogs by circles. An arrow marks the sample mean. Carnassial lengths of the Woodland dogs range from 17.4–19.6 mm, with a mean of 18.27 mm and a standard deviation of .74 mm (Table 4). The Kincaid dog is much smaller than the Black Earth dogs and the smallest of the Woodland dogs, but falls within the range of four other small dogs from Clear Lake Village in central Illinois and the Cox, Deposit Landing, and Stearns sites in northeastern Alabama.

To broaden the sample even more, earlier Archaic and later Mississippian dogs from Southeastern sites are compared. Figure 9 plots carnassial length of the Kincaid

***Table 3. Comparative Metric Data from Other Southeastern Sites.***

| Period, Site, and Location | Specimen Number (if available) | Length of Carnassial ($M_1$) |
|---|---|---|
| **Archaic Period** | | |
| Andrew's Run (Muhlenberg Co., KY)[a] | 1–8, 1–10, 1–11, 1–14, 1–15, 1–16 | 16.9, 18.80, 17.5, 20.0, 17.6, 18.8 |
| Annis Shell (Butler Co., KY)[a] | 1–145, 1–146, 1–147, 1–148, 1–149, 1–150, 1–151, 1–152, 1–153 | 18.3, 17.5, 17.8, 19.8, 19.2, 19.4, 18.7, 17.8, 18.3 |
| Barrett (McLean Co., KY)[a] | 1–108, 1–113, 1–114 | 17.6, 18.2, 17.7 |
| Bear Creek Cave (Colbert Co., AL)[a] | 2–107 | 17.8 |
| Bowles (Ohio Co., KY)[a] | 1–45, 1–88 | 19.3, 18.7 |
| Butterfield (McLean Co., KY)[a] | 1–119, 1–120, 1–121 | 17.0, 18.0, 20.2 |
| Chiggerville (Ohio Co., KY)[a] | 1–50, 1–51, 1–59, 1–61, 1–73, 1–91 | 18.9, 18.7, 18.9, 18.5, 18.8, 18.2 |
| Dust Cave (Lauderdale Co., AL[b] | B.1, B.3, B.4 | 18.20, 20.71, 19.02 |
| Flint River (Madison Co., AL)[a] | 40–3, 40–5, 40–7, 40–8, 40–9, 40–11, 40–14, 40–16, 40–19 | 19.5, 18.7, 17.5, 17.9, 19.2, 16.5, 18.7, 17.3, 17.8 |
| Flint Shop (Lauderdale Co., AL[3] | 2–6, 2–17 | 18.4, 18.3 |

***Table 3. Comparative Metric Data from Other Southeastern Sites, Continued.***

| Period, Site, and Location | Specimen Number (if available) | Length of Carnassial ($M_1$) |
|---|---|---|
| **Archaic Period, continued** | | |
| Indian Knoll (Ohio Co., KY)[a] | 1-4, 1-12, 1-24, 1-26, 1-30, 1-31, 1-34, 1-35, 1-44, 1-53, 1-55, 1-56, 1-57, 1-60, 1-117, 1-129, 1-130, 1-131, 1-132, 1-133, 1-134 | 19.7, 17.7, 18.0, 18.3, 17.8, 16.8, 18.5, 19.7, 17.5, 17.8, 19.0, 18.2, 18.8, 18.7, 19.7, 18.5, 18.3, 17.7, 19.0, 19.0, 20.0 |
| Jackson (Ohio Co., KY)[a] | 1-1, 1-2, 1-21, 1-22, 1-81, 1-82, 1-83, 1-83a, 1-89 | 20.0, 17.0, 20.0, 20.5, 17.6, 19.6, 19.0, 17.5, 19.0 |
| Jimtown Hill (Ohio Co., KY)[a] | 1-41, 1-62, 1-63, 1-64, 1-65, 1-66, 1-67, 1-68, 1-69 | 19.0, 19.0, 17.3, 19.5, 18.5, 17.6, 17.4, 20.0, 18.6 |
| Kirkland (McLean Co., KY)[a] | 1-19, 1-96, 1-101, 1-105 | 17.6, 20.0, 19.8, 18.8 |
| Land (Lauderdale Co., AL)[a] | 2–14 | 16.6 |
| Little Bear Creek (Colbert Co., AL)[a] | 2-93, 2-94, 2-96, 2-97, 2-100 | 18.7, 18.0, 19.7, 20.2, 19.2 |
| Long Branch (Lauderdale Co., AL)[a] | 2–16 | 17.2 |
| Mason Island (Limestone Co., AL)[a] | 40–2 | 18.0 |
| Mulberry Creek (Colbert Co., AL)[a] | 2–1, 2–2, 2–5, 2–8, 2–9, 2–23, 2–24, 2–30, 2–31 | 21.3, 20.7, 19.3, 21.0, 20.6, 19.0, 18.7, 18.2, 19.0 |
| Perry (Lauderdale Co., AL)[a] | 2-7, 2-12, 2-13, 2-15, 2-28, 2-32, 2-36, 2-43, 2-45, 2-48, 2-49, 2-51, 2-52, 2-53, 2-55, 2-58, 2-60, 2-61, 2-64, 2-70, 2-72, 2-73, 2-74, 2-77, 2-78, 2-80, 2-82 | 19.5, 19.2, 17.5, 18.7, 20.3, 19.6, 19.2, 17.0, 18.9, 18.7, 20.0, 18.5, 17.4, 18.4, 16.8, 19.6, 19.4, 17.9, 17.8, 18.1, 18.4, 19.4, 18.4, 17.4, 18.6, 16.8, 18.7 |
| Read (Butler Co., KY)[a] | 1-77, 1-78, 1-79, 1-84, 1-85, 1-86, 1-107, 1-109, 1-125, 1-126, 1-127, 1-136, 1-137, 1-138, 1-139, 1-140, 1-141, 1-142, 1-143, 1-144, 1-154 | 19.7, 20.4, 19.2, 18.7, 19.2, 18.2, 18.0, 18.7, 19.4, 17.8, 17.0, 17.4, 18.0, 18.4, 20.3, 18.9, 17.2, 18.4, 18.3, 20.0, 18.0 |
| Rodgers Shelter (Benton Co., MO[c] | – | 19.8 |
| Ward (McLean Co., KY)[a] | 1-3, 1-5, 1-27, 1-37, 1-38, 1-39, 1-54, 1-70, 1-71, 1-72, 1-74, 1-98, 1-99, 1-128 | 17.7, 20.0, 18.8, 17.8, 18.0, 19.0, 19.5, 18.5, 20.7, 17.5, 18.0, 17.3, 19.5, 17.3 |
| Whitesburg Bridge (Madison Co., AL)[a] | 40-20, 40-25 | 17.5, 19.8 |
| **Woodland Period** | | |
| Bell Shelter (Metcalfe Co., KY)a | 70-1 | 18.6 |
| Clear Lake Village (Tazewell Co., IL)a | $T^V1$ | 17.4 |

***Table 3. Comparative Metric Data from Other Southeastern Sites, Continued.***

| Period, Site, and Location | Specimen Number (if available) | Length of Carnassial ($M_1$) |
|---|---|---|
| **Woodland Period, continued** | | |
| Cox (Jackson Co., AL)a | 66-1, 66-3, 66-7 | 17.5, 17.9, 19.2 |
| Deposit Landing (Madison Co., AL)a | 66-14, 66-15 | 19.0, 17.5 |
| Miller Cave (Pulaski Co., MO)d | adult dog | 18.6 |
| Morton Mound (Fulton Co., IL)a | F14-8 | 19.6 |
| Riley (Jackson Co., AL)a | 66-11 | 18.2 |
| Stearns (Jackson Co., AL)a | 66-33, 66-35 | 17.5, 18.2 |
| Mississippian Period | | |
| Annis Village (Butler Co., KY)a | 71-1 | 20.8 |
| Citico (Monroe Co., TN)e | F.60 | 19.6 |
| Fisher (Will Co., IL)a | –, 3A1, P23a, P5-P6 | 18.5, 22.2, 20.2, 19.0 |
| Greenhouse (Marksville, LO)a | 25-1, 25-2, 25-2a, 25-3, 25-4 | 20.4, 19.8, 19.2, 18.5, 20.5 |
| Hardin Village (Greenup Co., KY) a | 69-2 | 19.7 |
| Henry Island (Marshall Co., KY)a | 66-12, 66-13 | 18.1, 19.1 |
| Morris Village (Hopkins Co., KY)a | 71-4 | 20.5 |
| Toqua (Monroe Co., TN)e | B.1, B.2, B.3, B.4 | 20.7, 20.0, 18.3, 21.4 |

[a]Data from Haag (1948:Table 1).
[b]Data from Morey (1994:Table 1) and Walker et al. (2005: Table 3)
[c]Data from McMillian (1970:Table 1)
[d]Data from Darwent et al. (2001:Table 3)
[e]Data from Parmalee and Bogan (1978:Table 1)

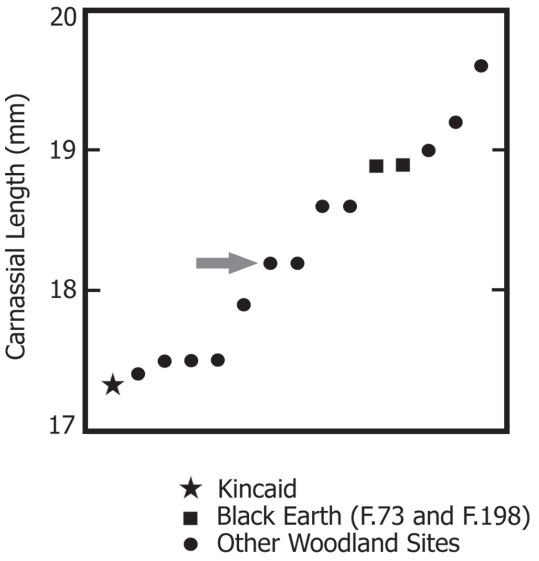


***Figure 8. Comparison of carnassial ($M_1$) length among Woodland dogs.***

***Table 4. Summary of Comparative Metric Data from Southeastern Sites by Period.***

| | Archaic | Woodland | Mississippian |
|---|---|---|---|
| Number of Sites | 25 | 8 | 8 |
| Number of Cases | 172 | 12 | 19 |
| Minimum (mm) | 16.5 | 17.4 | 18.1 |
| Maximum (mm) | 21.3 | 19.6 | 22.2 |
| Range (mm) | 4.8 | 2.2 | 4.1 |
| Median (mm) | 18.7 | 18.2 | 19.8 |
| Mean (mm) | 18.63 | 18.27 | 19.82 |
| Standard Deviation (mm) | 1.03 | 0.74 | 1.1 |

Note: Data from Table 3. The Archaic sample also includes three dogs from the Black Earth site (see Table 2 for data).

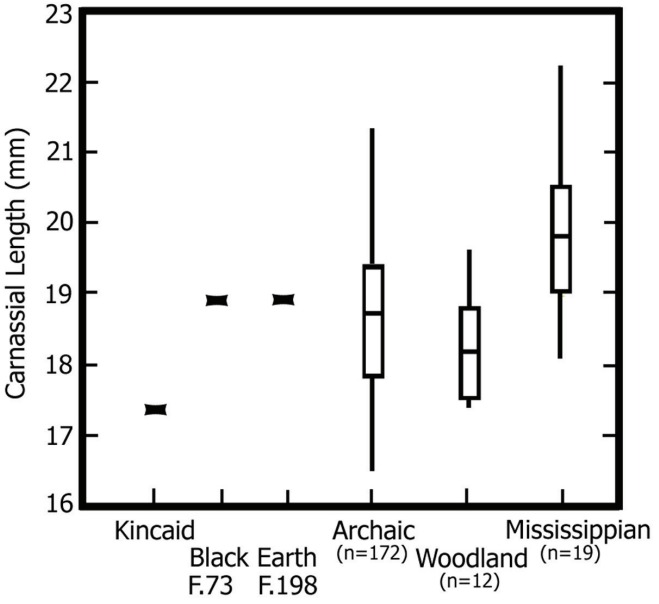


***Figure 9. Comparison of carnassial length ($M_1$) among Southeastern dogs.***

and Black Earth dogs and the Woodland sample discussed above. The Kincaid dog falls at the lowest end of the scale, while the Black Earth dogs lie within the upper range of this Woodland sample, as was apparent in the previous graph. When dogs from the Archaic and Mississippian periods are considered, the Kincaid dog falls within the smallest 10 percent of the Archaic sample, which includes three dogs from the Black Earth site (Table 2) along with 169 dogs from 24 other southeastern sites in central Missouri, Kentucky, and Alabama (Table 3). Carnassial lengths of Archaic dogs range from 16.5–21.3 mm, with a mean of 18.63 mm and a standard deviation of 1.03 mm (Table 4). The Kincaid dog falls far below the range of the Mississippian sample, which includes 19 dogs from eight southeastern sites in northeastern Illinois, Kentucky, eastern Tennessee, and central Louisiana (Table 3). Carnassial lengths of Mississippian dogs range from 18.1–22.2 mm, with a mean of 19.82 mm and a standard deviation of 1.1 mm (Table 4). The results of this comparative study indicate the Kincaid dog was not typical in size, but that it was indeed small for the time period and region from which it was recovered.

## Conclusions

Dog burials are uncommon features on Woodland sites in southern Illinois, and few examples exist in this region for earlier or later time periods. Not only is the Baumer phase dog burial from the Kincaid site a rare find in southern Illinois, but the dog itself is also unique due to its petite stature. An initial comparison of select skeletal elements suggests the animal was about the size of a modern fox terrier, which stands around 40 cm tall at shoulder height. Interestingly, one of the Early Archaic dog burials from the Koster site in western Illinois was also first described as being about the size of a fox terrier (Struever and Holton 1979:49). Based on metric comparisons with other southeastern domestic canines, the Kincaid dog appears more similar in size to a small dog

from the Archaic period than many of its Woodland contemporaries, although other dogs of similarly small stature are present on southeastern Woodland sites.

Some of the dental abnormalities observed on the Kincaid dog may be explained by its size since it is common for small dogs to exhibit anomalies in their dentition due to teeth being crowded into petite jaws (Morey 1992:198), although congenital absence of dentition is considered to be an inherited genetic trait (Axenovich et al. 2006; Miles and Grigson 1990:87). Partial anodontia, the failure of one or more teeth to develop, should be confirmed by x-ray because distinguishing the difference between congenital absence and ante-mortem tooth loss can be difficult (Hillson 2005:281; Miles and Grigson 1990:62). Without x-ray examination of the Kincaid dog dentition, the absence of the upper and lower first premolars and left lower third molar appears to be congenital. The cause of the dental anomaly observed in the right mandible is uncertain.

What circumstances surrounded the burial of this dog more than 2,000 years ago? There is no evidence that the dog was ritually sacrificed, and nothing suggests that this dog was eaten during a feast as has been noted elsewhere in the Southeast and other parts of North America (Borgic and Galloy 2004; Jackson and Scott 1995:106; Kerber 1997; Schwartz 2000; Snyder 1991), although lack of evidence does not necessarily rule out these possibilities as cause of death. Its intentional and careful burial does suggest that this particular dog held a special status in life that not all dogs had achieved. Perhaps the dog's small size, combined with a not-so-small spirit, endeared it to those who laid it to rest long ago. How this dog gained its status in life, whether it was as a skilled hunter, a loyal companion, or a diligent guardian, can only be speculated upon.

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## References Cited

Allen, Glover D.
1920 Dogs of the American Aborigines. *Bulletin of the Museum of Comparative Zoology at Harvard College* 63(9):431–517. Cambridge.

Axenovich, T. I., A. V. Kulikova, S. P. Knyazev, I. V. Zorkoltseva, and P. M. Borodin
2006 Polymorphism of Dental Formula and Segregation of Its Variants in a Pedigree of Kerry Blue Terrier Dogs. *Russian Journal of Genetics* 42(3):327–332.

Bloom, Jonathan A.
1982 Patterns of Middle and Late Woodland Animal Exploitation. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 959–985. Research Papers 33. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Borgic, Quentina L., and Joseph M. Galloy
2004 Domesticated Dog Remains from the Janey B. Goode Site. Paper presented at the joint meeting of the Southeastern Archaeological Conference and the Midwestern Archaeological Conference, St. Louis, Missouri.

Breitburg, Emanuel
1982 Analysis of Area A Fauna. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 863–957. Research Papers 33. Center for Archaeological Investigations, Southern Illinois University, Carbondale.
1992 The Faunal Assemblage. In *The Petitt Site (11-Ax-253), Alexander County, Illinois*, edited by Paul A. Webb, pp. 295–329. Research Paper 58. Center for Archaeological Investigations, Southern Illinois University, Carbondale.
1999 Faunal Remains. In *Archaeological Investigations at the Rose Hotel (11Hn-116), Hardin County, Illinois*, edited by Mark J. Wagner and Brian M. Butler, pp. 409–427. Technical Report 99-3. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Buchanan, Meghan E.
2003 Patterns of Faunal Utilization at Kincaid Mounds, Massac County, Illinois. Unpublished Master's thesis, Department of Anthropology, Southern Illinois University, Carbondale.

Butler, Brian M.
2006 Before the Mounds: The Baumer Occupation at the Kincaid Site. *Illinois Antiquity* 41(2):3–6.

Butler, Brian M., and Richard W. Jefferies
1986 Crab Orchard and Early Woodland Cultures in the Middle South. In *Early Woodland Archaeology*, edited by Kenneth B. Farnsworth and Thomas E. Emerson, pp. 523–534. Kampsville Seminars in Archeology Vol. 2. Center for American Archeology Press, Kampsville, Illinois.

Butler, Brian M., and Charles R. McGimsey
2000 Features and Postmolds. In *The Old Runway Site (11J-1009): A Late Woodland Settlement on the Big Muddy River*, edited by Brian M. Butler, pp. 59–143. Technical Report 2000-04. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Butler, Brian M., and Paul D. Welch
2003 Preliminary Report on the 2003 Archaeological Testing on State-owned Portions of the Kincaid Site, Massac County, Illinois. Report on file with the Center for Archaeological Investigations, Southern Illinois University, Carbondale.
2005 Mounds Lost and Found: New Research at the Kincaid Site. *Illinois Archaeology* 17:138–153.

Cantwell, Anne-Marie
1980 Middle Woodland Dog Ceremonialism in Illinois. *The Wisconsin Archeologist* 61(4):480–496.

Cole, Fay-Cooper, Robert Bell, John Bennett, Joseph Caldwell, Norman Emerson, Richard MacNeish, Kenneth Orr, and Roger Willis
1951 *Kincaid: A Prehistoric Illinois Metropolis*. University of Chicago Press, Chicago.

Colton, Harold S.
1970 The Aboriginal Southwestern Indian Dog. *American Antiquity* 35(2):153–159.

Clutton-Brock, Juliet
1963 The Origins of the Dog. In *Science in Archaeology: A Comprehensive Survey of Progress and Research*, edited by Donald Brothwell and Eric Higgs, pp. 267–274. Basic Books, New York.
1984 Dog. In *Evolution of Domesticated Animals*, edited by Ian L. Mason, pp. 198–211. Longman, London.
1995 Origins of the Dog: Domestication and Early History. In *The Domestic Dog: Its Evolution, Behaviour, and Interactions with People*, edited by James Serpell, pp. 7–20. Cambridge University Press, Cambridge.

Craig, Joseph, and Michael J. McNerney
1990 *Phase II Archaeological Investigations of Prehistoric Sites at Consolidation Coal Company's Rend Lake Mine, Jefferson County, Illinois*. Cultural Resources Management Report 141. American Resources Group, Carbondale, Illinois.

Cremin, William M.
1975 Throgmorton Dam Site (24B3-110). In *Archaeological Investigations in the Cedar Creek Reservoir, Jackson County, Illinois*, edited by Michael J. McNerney, pp. 203–242. Southern Illinois Studies 12. University Museum, Southern Illinois University, Carbondale.

Crockford, Susan J.
1997 *Osteometry of Makah and Coast Salish Dogs*. Archaeology Press, Simon Fraser University, Burnaby.

Darwent, Christyann M., and J. Eric Gilliland
2001 Osteological Analysis of Domestic Dogs from Burials in Southern Missouri. *The Missouri Archaeologist* 62:149–169.
Denny, Sidney G.
1970 *Rend Lake Archaeology 1967 and 1968 Seasons*. Southern Illinois Studies 4. University Museum, Southern Illinois University, Carbondale.
Driesch, Angela von den
1976 *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Peabody Museum Bulletin 1. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.
Falk, Carl R., and Walter E. Klippel
1987 Faunal Analysis. In *Phase II Archaeological Investigations in the Westfield Extension, Burning Star Mine #5, Jackson County, Illinois*, edited by Ronald E. Pulcher and Leah D. Rogers, pp. 165–176. Cultural Resources Management Report 123. American Resources Group, Carbondale, Illinois.
Gilmore, Zachary
2006 Baumer Phase Subsistence and Settlement at the Kincaid Site, Southern Illinois. Manuscript on file, Center for Archaeological Investigations, Southern Illinois University, Carbondale.
Haag, William G.
1948 An Osteometric Analysis of Some Aboriginal Dogs. *University of Kentucky Reports in Anthropology* 7(3):107–264.
Hargrave, Michael L., Brian M. Butler, Neal H. Lopinot, and Timothy W. Pugh
1992 *Mollie Baker (11-J-964): A Woodland Period Site in the Kinkaid Creek Drainage, Jackson County, Illinois*. Technical Report 1992-03. Center for Archaeological Investigations, Southern Illinois University, Carbondale.
Hargrave, Michael L., Charles R. McGimsey, and Neal H. Lopinot
1991 Archaeological Investigations at the Southern Illinois Airport, Jackson County, Illinois. Manuscript on file, Center for Archaeological Investigations, Southern Illinois University, Carbondale.
Hill, Fredrick C.
1975 Animal Remains from the Grammar Rockshelter. In *Archaeological Investigations in the Cedar Creek Reservoir, Jackson County, Illinois*, edited by Michael J. McNerney, pp. 59–73. Southern Illinois Studies 12. University Museum, Southern Illinois University, Carbondale.
Hillson, Simon
2005 *Teeth*. 2nd ed. Cambridge University Press, Cambridge.
Hogue, S. Homes
2006 Carbon Isotope and Microwear Analysis of Dog Burials: Evidence for Maize Agriculture at a Small Mississippian Protohistoric Site. In *Integrating Zooarchaeology*, edited by Mark Maltby, pp. 123–130. Oxbow Books, Oxford.

Horard-Herbin, Marie-Pierre
2000 Dog Management and Use in the Late Iron Age: The Evidence from the Gallic Site of Levroux (France). In *Dogs Through Time: An Archaeological Perspective*, edited by Susan J. Crockford, pp. 115–121. British Archaeological Reports International Series 889. Archaeopress, Oxford.

Jackson, H. Edwin, and Susan L. Scott
1995 The Faunal Record of the Southeastern Elite: The Implications of Economy, Social Relations, and Ideology. *Southeastern Archaeology* 14:103–119.

Jefferies, Richard W.
1982 The Black Earth Site. In *The Carrier Mills Archaeological Project: Human Adaptation in the Saline Valley, Illinois*, edited by Richard W. Jefferies and Brian M. Butler, pp. 77–451. Research Papers 33. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Kelly, Lucretia
1986 Faunal Analysis. In *Final Report of Cultural Resource Data Recovery at Archaeological Sites RL-188 and RL-114, Rend Lake, Illinois*, edited by Mark J. Wagner and Mary R. McCorvie, pp. 204–216. Cultural Resource Management Report 29. U.S. Army Corps of Engineers, St. Louis District.

Kent, Susan Kent
1993 Variability in Faunal Assemblages: The Influence of Hunting Skill, Sharing, Dogs, and Mode of Cooking on Faunal Remains at a Sedentary Kalahari Community. *Journal of Anthropological Archaeology* 12(4):323–385.

Kerber, Jordan E.
1997 Native American Treatment of Dogs in Northeastern North America: Archaeological and Ethnohistorical Perspectives. Archaeology of Eastern NorthAmerica 25: 81–96.

Koop, Ben F., and Susan J. Crockford
2000 Ancient DNA Evidence of a Separate Origin for North American Indigenous Dogs. In *Dogs Through Time: An Archaeological Perspective*, edited by Susan J. Crockford, pp. 271–285. British Archaeological Reports International Series 889. Archaeopress, Oxford.

Lapham, Heather A.
2008 Faunal Remains. In *The Kaesberg-Schaudt Site (11R594) and Late Woodland Settlement in the Mary's River Valley*, edited by Brian M. Butler, Mark J. Wagner, Anne C. DiCosola, Eve A. Hargrave, Heather A. Lapham, Sarah J. Monteith, and Kathryn E. Parker, pp. 141–148 and pp. 261–268. Research Reports 13, Illinois Transportation Archaeological Research Program, University of Illinois at Urbana-Champaign.

Leonard, Jennifer A., Robert K. Wayne, Jane Wheeler, Raúl Valadez, Sonia Guillén, and Carles Vilà
2002 Ancient DNA Evidence for Old World Origin of New World Dogs. *Science* 298(5598):1613–1616.

Lewis, Thomas M. N., and Madeline K. Lewis
1961 *Eva: An Archaic Site*. University of Tennessee Press, Knoxville.
MacCord, Howard A., and William T. Buchanan
1980 *The Crab Orchard Site, Tazewell County, Virginia*. Special Publication 8. Archeological Society of Virginia, Richmond.
McMillan, R. Bruce
1970 Early Canid Burial from the Western Ozark Highland. *Science* 167(3922):1246–1247.
McNerney, Michael J. (editor)
1975 *Archaeological Investigations in the Cedar Creek Reservoir, Jackson County, Illinois*. Southern Illinois Studies 12. University Museum, Southern Illinois University, Carbondale.
Martin, Terrance J.
1991 Animal Exploitation and the Crab Orchard Tradition: The View from the Little Muddy Rockshelter. Paper presented at the 36th annual Midwest Archaeological Conference, La Crosse, Wisconsin.
Martin, Terrance J., and Mary C. Masulis
1992 Faunal Analysis. In *The Little Muddy Rock Shelter: A Deeply Stratified Prehistoric Site in the Southern Till Plains of Illinois*, edited by Charles R. Moffat, William Cremin, Terrance J. Martin, Brad Koldehoff, and Mary R. McCorvie, pp. 427–471. Cultural Resources Management Report 186. American Resources Group, Carbondale, Illinois.
Maxwell, Moreau S.
1951 *Woodland Cultures of Southern Illinois*. Logan Museum Publications in Anthropology, Bulletin No. 7, Beloit College, Wisconsin.
Meadow, Richard H.
2000 The Contributions of Barbara Lawrence to the Study of Dogs, with a Comprehensive Listing of Her Measurement Definitions. In *Dogs Through Time: An Archaeological Perspective*, edited by Susan J. Crockford, pp. 35–48. British Archaeological Reports International Series 889. Archaeopress, Oxford.
Miles, A. E. W., and Caroline Grigson
1990 *Colyer's Variations and Diseases of the Teeth of Animals*. Revised ed. Cambridge University Press, Cambridge.
Morey, Darcy F.
1986 Studies on Amerindian Dogs: Taxonomic Analysis of Canid Crania from the Northern Plains. *Journal of Archaeological Science* 13:119–145.
1992 Size, Shape an Development in the Evolution of the Domestic Dog. *Journal of Archaeological Science* 19:181–204.
1994a The Early Evolution of the Domestic Dog. *American Scientist* 82(4):336–347.
1994b *Canis* Remains from Dust Cave. *Journal of Alabama Archaeology* 40:163–172.
2006 Burying Key Evidence: The Social Bond Between Dogs and People. *Journal of Archaeological Science* 33(2):158–175.

Morey, Darcy F., and Michael D. Wiant
1992 Early Holocene Domestic Dog Burials from the North American Midwest. *Current Anthropology* 33(2):224–229.

Neumann, George K.
1935 Faunal Remains from the Kincaid Site (Mx$^{v}$1A, Mx$^{v}$1B, Mx$^{o}$4). Manuscript on file, Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Olsen, Stanley J.
1974 Early Domestic Dogs in North America and Their Origins. *Journal of Field Archaeology* 1(3/4):343–345.
1985 *Origins of the Domestic Dog: The Fossil Record*. University of Arizona Press, Tucson.

Parmalee, Paul W.
1959 Animal Remains from the Modoc Rock Shelter Site, Randolph County, Illinois. In *Summary Report of Modoc Rock Shelter 1952, 1953, 1955, 1956*, edited by Melvin L. Fowler, pp. 61–65. Report of Investigations 8. Illinois State Museum, Springfield.
1971 Letter from Paul W. Parmalee of the Illinois State Museum, Springfield, to Mr. Frank Rackerby of the University Museum, Southern Illinois University Carbondale, regarding the identification of the human and nonhuman animal bones from Burial 4 at the Peter's Cave site. Dated February 24, 1971. On file with the Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Parmalee, Paul W., and Arthur E. Bogan
1978 Cherokee and Dallas Dog Burials from the Little Tennessee River Valley. *Tennessee Anthropologist* 3(1):100–112.

Pauketat, Timothy R., Christy L. Wells, and William I. Woods
1984 *Cultural Resources Assessments and Testing of Specified Sties in the Rend Lake Project Area, Franklin and Jefferson Counties, Illinois*. Cultural Resource Management Report 9. U.S. Army Corps of Engineers, St. Louis District.

Pavao-Zuckerman, Barnet
2001 A Dog Burial Excavated at the Armorel Site, Arkansas (3MS23). *Arkansas Archeologist* 40:8–10.
2007 Deerskins and Domesticates: Creek Subsistence and Economic Strategies in the Historic Period. *American Antiquity* 72:5–33.

Pulcher, Ronald E., and Leah D. Rogers
1987 *Phase II Archaeological Investigations in the Westfield Extension, Burning Star Mine #5, Jackson County, Illinois*. Cultural Resources Management Report 123. American Resources Group, Carbondale, Illinois.

Reyman, Jonathan E.
1971 *Archaeological Excavations at Peter's Cave, Jackson County, Illinois*. Southern Illinois Studies 7. University Museum, Southern Illinois University, Carbondale.

Savolainen, Peter, Ya-ping Zhang, Jing Luo, Joakim Lundeberg, and Thomas Leitner
2002 Genetic Evidence for an East Asian Origin of Domestic Dogs. *Science* 298(5598):1610–1613.

Schwartz, Marion
1997 *A History of Dogs in the Early Americas*. Yale University Press, New Haven.
2000 The Form and Meaning of Maya and Mississippian Dog Representations. In *Dogs Through Time: An Archaeological Perspective*, edited by Susan J. Crockford, pp. 217–226. British Archaeological Reports International Series 889. Archaeopress, Oxford.

Shigehara, Nobou, Satoru Onodera, and Moriharu Eto
1997 Sex Determination by Discriminant Analysis and Evaluation of Non-metrical Traits in the Dog Skeleton. In *Osteometry of Makah and Coast Salish Dogs*, by Susan J. Crockford, Appendix A, pp. 113–126. Archaeology Press, Simon Fraser University, Burnaby.

Silver, I. A.
1969 The Ageing of Domestic Animals. In *Science in Archaeology: A Survey of Progress and Research*, edited by Don Brothwell and Eric Higgs, pp. 283–302. 2nd ed. Praeger Publishers, New York.

Snyder, Lynn M.
1991 Barking Mutton: Ethnohistoric, Ethnographic, Archaeological, and Nutritional Evidence Pertaining to the Dog as a Native American Food Resource on the Plains. In *Beamers, Bobwhites, and Blue-Points: Tributes to the Career of Paul W. Parmalee*, edited by James R. Purdue, Walter E. Klippel, and Bonnie W. Styles, pp. 359–378. Scientific Papers Vol. 23. Illinois State Museum, Springfield.

Stephens, Jeanette E.
1991 Crab Orchard Settlement Patterns in the Big Muddy Drainage of Southern Illinois. Paper presented at the 36th annual Midwest Archaeological Conference, La Crosse, Wisconsin.

Struever, Stuart, and Felicia Antonelli Holton
1979 *Koster: Americans in Search of Their Prehistoric Past*. Doubleday, New York.

Sumner-Smith, G.
1966 Observations of Epiphyseal Fusion of the Canine Appendicular Skeleton. *Journal of Small Animal Practice* 7(4):303–311.

Verginelli, Fabio, Cristian Capelli, Valentina Coia, Marco Musiani, Mario Falchetti, Laura Ottini, Raffaele Palmirotta, Antonio Tagliacozzo, Iacopo De Grossi Mazzorin, and Renato Mariani-Costantini

2005 Mitochondrial DNA from Prehistoric Canids Highlights Relationships Between Dogs and South-East European Wolves. *Molecular Biology and Evolution* 22(12):2541–2551.

Vilà, Carles, Jesús E. Maldonado, and Robert K. Wayne

1999 Phylogenetic Relationships, Evolution, and Genetic Diversity of the Domestic Dog. *The Journal of Heredity* 90(1):71–77.

Vilà, Carles, Peter Savolainen, Jesús E. Maldonado, Isabel R. Amorim, John E. Rice, Rodney L. Honeycutt, Keith A. Crandall, Joakim Lundeberg, and Robert K. Wayne

1997 Multiple and Ancient Origins of the Domestic Dog. *Science* 276(5319):1687–1689.

Wagner, Mark J.

1992 Faunal Analysis. In *Phase III Archaeological Investigations at the Thanksgiving Site (21D3-242) in Consolidation Coal Company's Burning Star Mine #2, Pinckneyville Pit #3 Extension, Perry County, Illinois*, edited by Mark J. Wagner, Mary R. McCorvie, Charles Foor, and Kathryn Parker, pp. 127–128. Cultural Resource Management Report 188. American Resources Group, Carbondale, Illinois.

Wagner, Mark J., and Brian M. Butler

1999 *Archaeological Investigations at the Rose Hotel (11Hn-116), Hardin County, Illinois*. Technical Report 99-3. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Wagner, Mark J., and Mary R. McCorvie

1986 *Final Report of Cultural Resource Data Recovery at Archaeological Sites RL-188 and RL-114, Rend Lake, Illinois*. Cultural Resource Management Report 29. U.S. Army Corps of Engineers, St. Louis District.

Wagner, Mark J., Mary R. McCorvie, Charles Foor, and Kathryn Parker

1992 *Phase III Archaeological Investigations at the Thanksgiving Site (21D3-242) in Consolidation Coal Company's Burning Star Mine #2, Pinckneyville Pit #3 Extension, Perry County, Illinois*. Cultural Resource Management Report 188. American Resources Group, Carbondale, Illinois.

Walker, Renee B., Darcy F. Morey, and John H. Relethford

2005 Early and Mid-Holocene Dogs in Southeastern North America: Examples from Dust Cave. *Southeastern Archaeology* 24(1):83–92.

Warren, Diane M.

2000 Paleopathology of Archaic Period Dogs from the North American Southeast. In *Dogs Through Time: An Archaeological Perspective*, edited by Susan J. Crockford, pp. 105–121. British Archaeological Reports International Series 889. Archaeopress, Oxford.

2004 Skeletal Biology and Paleopathology of Domestic Dogs from Prehistoric Alabama, Illinois, Kentucky, and Tennessee. Doctoral Dissertation, Department of Anthropology, Indiana University, Bloomington.

Webb, William S.

1946 Indian Knoll Site, Oh 2, Ohio County, Kentucky. *University of Kentucky. Reports in Archaeology and Anthropology* 4:115–365.

1950a The Carlson Annis Mound, Site 5, Butler County, Kentucky. *University of Kentucky. Reports in Archaeology and Anthropology* 7:267–354.

1950b The Read Shell Midden, Site 10, Butler County, Kentucky. *University of Kentucky. Reports in Archaeology and Anthropology* 7(5):357–401.

Webb, William S., and David L. DeJarnette

1942 An Archeological Survey of Pickwick Basin in the Adjacent Portions of the States of Alabama, Mississippi, and Tennessee. *Bureau of American Ethnology Bulletin* 129. U.S. Government Printing Office. Smithsonian Institution, Washington D.C.

Webb, William S., and William G. Haag

1939 The Chiggerville Site, Site 1, Ohio County, Kentucky. *University of Kentucky. Reports in Archaeology and Anthropology* 4:1–62.

1947 Archaic Sites in McLean County, Kentucky. *University of Kentucky. Reports in Archaeology and Anthropology* 7:1–46.

Weisman, Brent R.

1992 *Excavations on the Franciscan Frontier: Archaeology at the Fig Springs Mission*. University Press of Florida, Gainesville.

Zeder, Melinda A.

2006 Archaeological Approaches to Documenting Animal Domestication. In *Documenting Domestication: New Genetic and Archaeological Paradigms*, edited by Melinda A. Zeder, Daniel G. Bradley, Eve Emshwiller, and Bruce D. Smith, pp. 171–180. University of California Press, Berkeley.