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A LATE ARCHAIC PERIOD DOG BURIAL FROM THE TUCSON BASIN, ARIZONA

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ABSTRACT

In November 1998, the remains of the cranium of a large, mature dog *(Canis familiaris)* were found in a cultural deposit during archaeological testing at the Late Archaic Costello-King site (AZ AA:12:503 [ASM]) in the northern Tucson Basin. The depositional context suggests a deliberate burial, and crude damage to the occipital area of the cranium indicates that the skull had been severed from the body prior to interment. A conventional AMS radiocarbon date on the bone gelatin yielded a date of 2600±50 B.P., and a ^{13}C of -10.0 ‰ obtained from the gelatin suggests a diet containing a significant C_4 component. We discuss the remains in terms of Late Archaic/Early Formative period human utilization of domestic canids in southern Arizona, and how the ^{13}C value might be used as a proxy measure for human diets of this time period.

RESUMEN

En noviembre de 1998, los restos de un cráneo canino (Canis familiaris) *de edad adulta, fue localizado en un depósito cultural durante las excavaciones preliminares arqueológicas del sitio del Periodo Arcaico Tardío Costello-King (AZ AA:12:503 [ASM]) al norte de la cuenca de Tucson. La deposición de los restos sugiere un entierro deliberado. El daño localizado en la porción occipital indica que el cráneo fue separado del cuerpo antes del enterramiento. Una datación convencional de radiocarbono (AMS) del tejido esponjoso del hueso proporciono la fecha 2600±50 A.P. y una lectura de -10.0 de ^{13}C sugiere una dieta con un componente significativo de C_4. Nosotros presentamos estos restos en términos de la utilización humana de caninos domesticados en la porción sur de Arizona durante el periodo Arcaico Tardío/Formativo Temprano, y cómo la identificación del componente ^{13}C puede ser utilizado como medida para establecer la dieta humana durante este periodo.*

In November 1998, a nearly complete but fragmented cranium of a large, mature dog *(Canis familiaris)* was recovered from a cultural deposit during archaeological test excavations of the northeastern section of the Costello-King site (AZ AA:12:503 [ASM]) in the northern Tucson Basin (Ezzo 1998). One of only a few of Late Archaic/Early Formative period dog burials yet discovered in south-

ern Arizona, it exhibits two unique characteristics. The animal is clearly a large dog, whereas all other described canids from roughly contemporaneous southern Arizona burials are smaller (e.g., James 1989; Lawrence 1966). In addition, the occipital area of the cranium shows evidence of damage, indicating that the animal's head was severed from its body before the cranium was interred in the pit.

In this article we describe the dog remains, the archaeological context, the accelerator mass spectroscopy (AMS) date associated with the remains, and discuss the domestication of the dog and the evidence for Late Archaic/Early Formative period domestic dog burials in southern Arizona, as well as the role of the domestic dog and the significance of deliberate burial of domestic canids during the Late Archaic period in southern Arizona.

One note on terminology is in order. We have chosen to use the more traditional designation "Late Archaic" to denote a period from approximately 3000 to 2200 B.P. We acknowledge that other terms, such as "Early Agricultural," recently have been proposed for this time period (see Huckell 1995); however, because it has not been demonstrated that agriculture characterized the subsistence practices of the inhabitants of southern Arizona during this period, we prefer the use of "Late Archaic."

THE COSTELLO-KING SITE: A BRIEF DESCRIPTION

The Costello-King site (AZ AA:12:503 [ASM]) is located on an alluvial fan on the first terrace (Qt2) above the current active floodplain of the Santa Cruz River. The sediments of the alluvial fan derive largely from the Cañada del Oro Wash, located slightly more than 1 km from the southern edge of the site (Figure 1). The boundaries of the site are unknown, because much of the Late Archaic cultural deposits are so deep that the surface scatter of later Formative period artifacts do not reflect the nature and extent of the earlier subsurface deposits. Archaeological investigations at the site indicate that the subsurface deposits extend over an area of at least 500,000 m^2 (Ezzo 1995; Ezzo and Deaver 1998; Riggs 1998).

The Late Archaic component of the Costello-King site was first identified during testing in the spring of 1995 (Ezzo 1995). Subsequent data recovery of a 3,200-m^2 area revealed two distinct levels of cultural deposits, one occurring from 0.7 to 1.1 m below ground surface, designated Unit II, and a second level occurring from 1.3 to 1.8 m below ground surface, designated Unit III. In addition to a variety of pits and hearths, a Late Archaic house was identified and excavated in Unit II, and two irrigation ditches were identified and sampled in Unit III. Both units yielded macrobotanical and palynological evidence of maize in quantities suggesting that the excavated portion of the site is situated in an ancient cornfield. The site appears to have been part of a highly dispersed settlement where maize

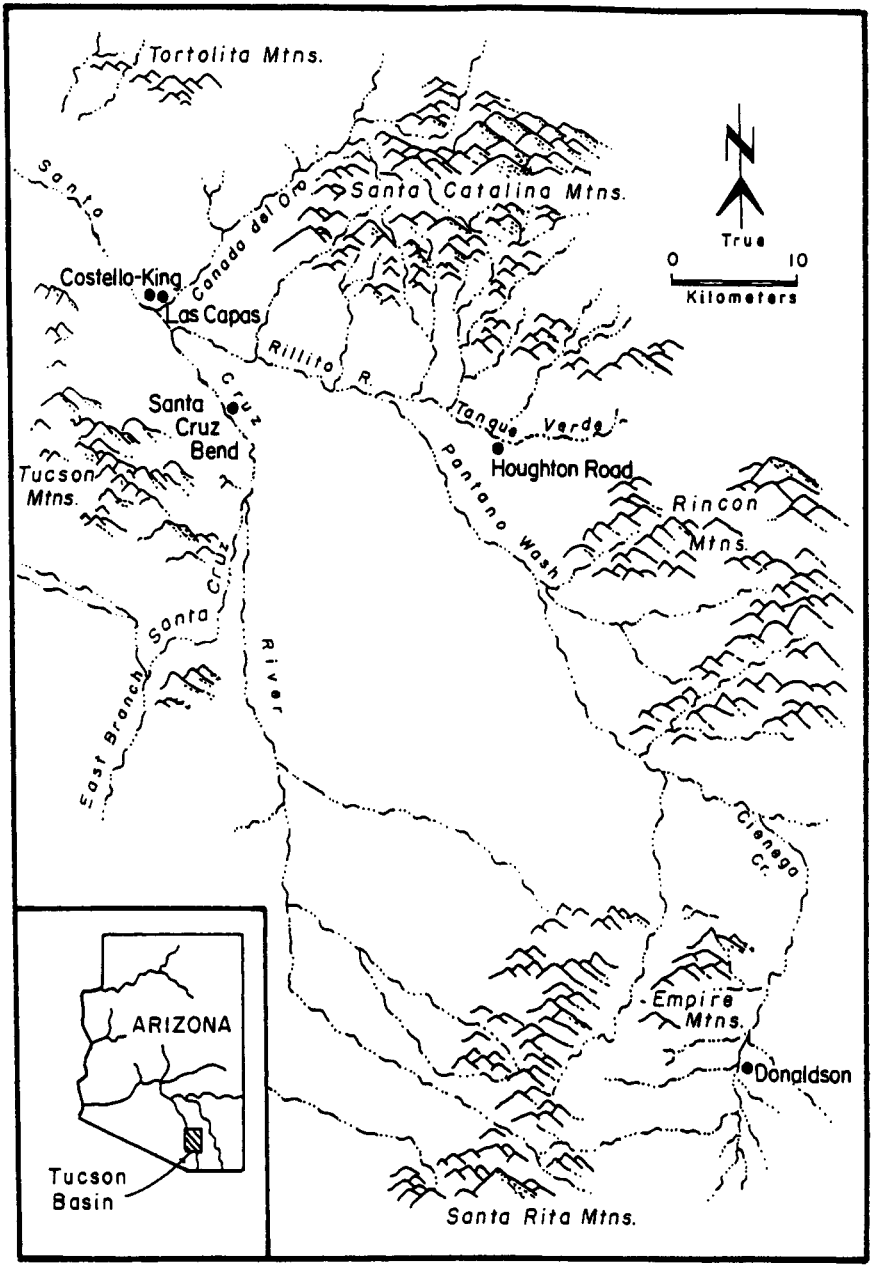

Figure 1. Map of the Tucson Basin and surrounding regions showing locations of the Costello-King site and other sites containing early dog burials.

farming of the local alluvial fan was a significant, seasonal food producing strategy (Ezzo and Deaver 1998).

Five radiocarbon dates were obtained from the site (Ezzo and Deaver 1998:Table 3). The conventional, uncalibrated radiocarbon dates from Unit II were from maize remains, and are 2620±60 B.P. (Beta–89863) and 2690±60 B.P. (Beta–89862). Three dates on maize from Unit III yielded conventional dates of 2780±60 B.P. (Beta–89859), 2770±60 B.P. (Beta–89860), and 2770±60 B.P. (Beta–89861). The Unit III dates correspond to the earliest maize dated in the Tucson Basin, and the irrigation features are the among the oldest dated in North America.

THE CANID REMAINS

The pit that yielded the canid cranium was identified on the floor of a backhoe trench during excavation. The top of the pit was located approximately 1.3 m below the present ground surface. The pit was circular, approximately 40 cm in diameter and 25 cm in depth, and characterized by ashy, very silty fill. Despite numerous flecks of charcoal in the fill, the canid remains exhibited no evidence of burning. Other than a few oval pits, no other cultural deposits were identified during the testing project.

The canid specimen included virtually all of both maxillae and premaxillae, and portions of the lacrimal bone, the right frontal bone, the right jugal bone, and the occipital bone (Figures 2, 3, and 4). This latter fragment included the presphenoid, basisphenoid, the auditory bullae, basioccipital, the occipital condyles, a small portion of the occipital crest, and small portions of the squamosal bone and the zygomatic process of the squamosal. More than 20 very small indeterminate cranial fragments were recovered as well. Dental elements included intact right and left fourth premolars and second molars. The macroscopic preservation of the cranial remains is good, and a single, Fourier-transform infrared analysis performed in the faunal analysis laboratory of the Department of Anthropology, University of Arizona, Tucson, revealed good preservation and limited re-crystallization of the hydroxyapatite (bone mineral).

This specimen was determined to be a dog because its morphology differed significantly from those of wolves, coyotes, and other wild canids. It resembled modern and prehistoric dogs in the comparative vertebrate and archaeological collections of the Arizona State Museum in overall form, the foreshortened face, and the presence of conspicuously reduced carnassials. The specimen represented a relatively large, mature individual that, when alive, weighed perhaps 20 kg (50 lbs.). Although its cranial dimensions were well within the range of prehistoric American dogs described from other regions of North America (e.g., Crockford 1997), the specimen fell into the larger of two size groups considered typical for native dogs (Olsen 1985), based on the osteometric measurements provided in Table 1 (following von den Driesch 1976).

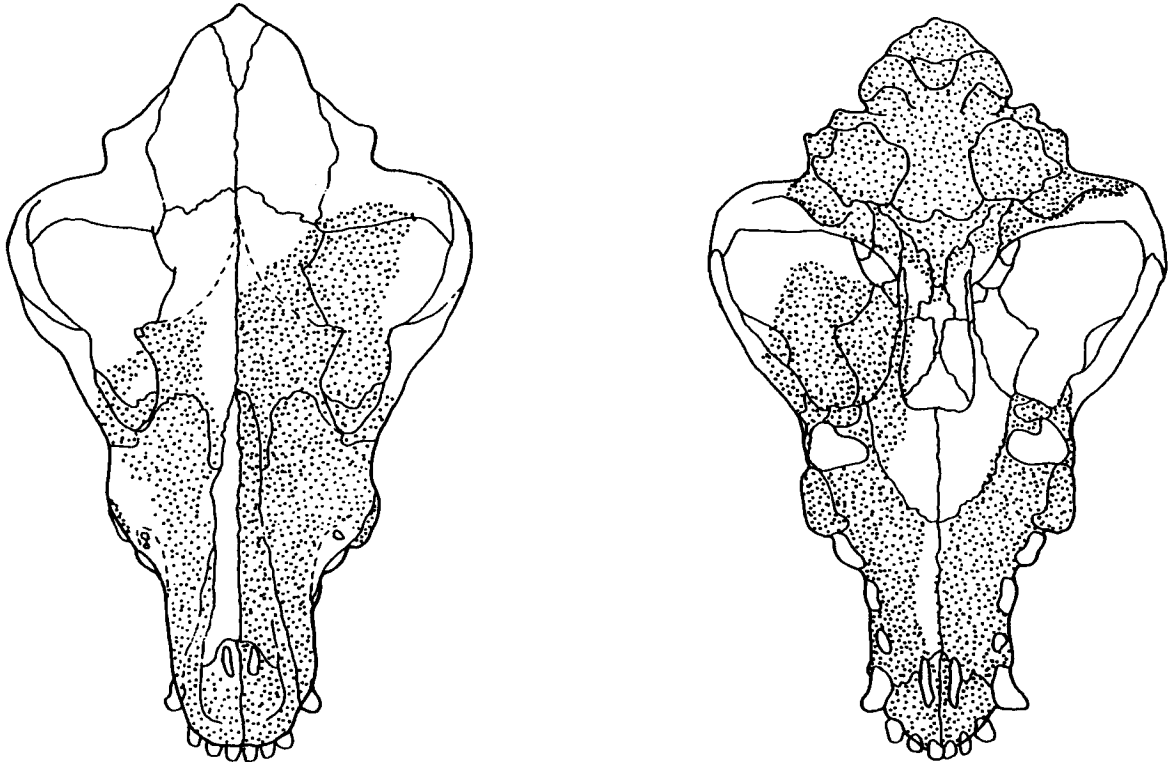

Figure 2. Dorsal (left) and ventral (right) view of canid cranium remains. (Shaded areas indicate cranial portions recovered.) Drawings by Lois Kain.

Figure 3. Canid maxillary remains. Photograph by Lois Kain.

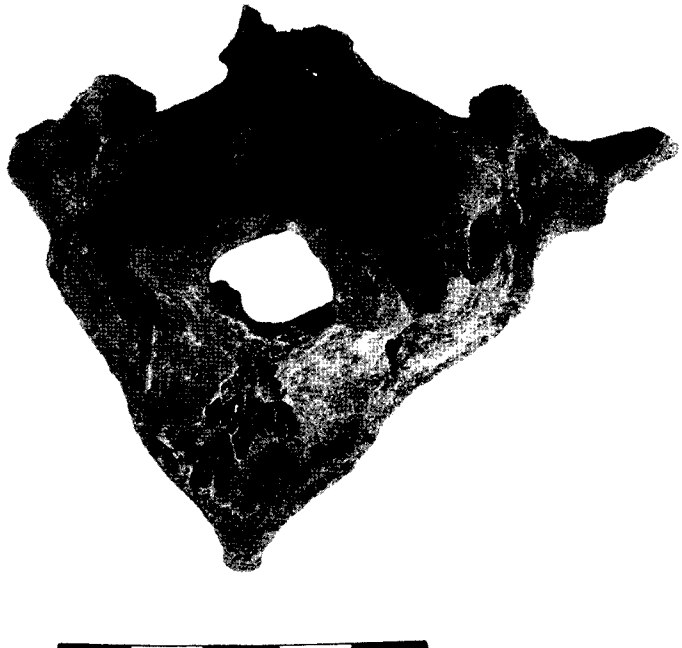

Figure 4. Canid occipital remains. Photograph by Lois Kain.

Table 1. Dental and Cranial Measurement of the Costello-King Site Dog Burial (Page 1 of 2).

Code	Description	Measurement (mm)
L	Length of upper fourth premolar	19.0
B	Posterior breadth of fourth premolar	8.0
GB	Anterior (greatest) breadth of fourth premolar	9.5
L	Anterior-posterior length of upper second premolar	9.5
B	Bucco-lingual breadth of upper second molar	7.1
1	Total cranial length (akrokranion – prosthion)	~190.0
7	Upper neurocranium length (akrokranion – frontal midpoint)	~96.5
8	Viscerocranium length (nasion – prosthion)	~77.2
9	Facial length (frontal midpoint – prosthion)	109.1
10	Greatest nasal length (nasion – rhinion)	~58.2
12	Snout length (oral border or orbit – prosthion)	~83.4
15	Length of cheektooth row (using alveoli, buccal side)	64.8
16	Length of molar row (using alveoli, buccal side)	20.5
17	length of premolar row (using alveoli, buccal side)	47.7
22	Greatest diameter of auditory bulla	~25.3
—	Perpendicular measurement relative to 22 of auditory bulla	~17.8
23	Greatest mastoid (occipital triangle, otion – otion)	~67.4
25	Outer breadth of occipital condyles	37.0
27	Greatest breadth of foramen magnum	18.3
28	Greatest height of foramen magnum	16.8
31	Least breadth of cranium (at postorbital constriction)	~35.8
32	Frontal breadth (ectorbitale – ectorbitale)	~56.4
33	Least breadth between orbits (entorbitale – entorbitale)	~40.4
34	Greatest palatal breadth (using alveoli borders)	~66.9

Table 1. Dental and Cranial Measurement of the Costello-King Site Dog Burial (Page 2 of 2).

Code	Description	Measurement (mm)
35	Least palatal breadth (behind canines)	~37.3
36	Breadth at outer canine alveoli	~38.6
37	Greatest inner height of orbit	~40.1
38	Cranium height (saggital crest – basioccipital)	52.7
40	Height of occipital triangle (akrokranion – basion)	42.2
—	Distance between lacrimal foramen and center of maxillary foramen	25.0

~ — estimated due to localized damage or breakage.
All but two measurements (those not coded by letters or numbers) follow von der Driesch (1976:42–45).

There was evidence of postmortem damage to the cranium. Most major fractures were recent, but there were at least two old fractures, one to the upper right braincase and another to the left zygomatic (Figure 5a). Extensive tool damage was found throughout the occipital triangle area, and to the occipital condyles in particular. The auditory bullae were also breached. The damage appears to have resulted from rough side-to-side sawing motions with a stone cutting tool, almost certainly when the dog's head was severed from its body. Two cutting planes were apparent, one that shaved the bone above the foramen magnum (Figure 5b), and a second turning anteriorly that affected the ventral portions of the occipital condyles and the auditory bullae (Figures 5b–c). Most or all of the damage occurred when the bone was relatively fresh. No other skeletal parts of the dog were found in the pit, indicating that the cranium was deliberately isolated from the postcranial elements and the mandible prior to interment. The fact that most of the teeth were missing, and all of those with single, conical roots, suggests that the cranium was not buried immediately after the dog's death; these teeth frequently drop out as a skull dries, especially if it is handled or otherwise jostled. This is consistent with the idea that the cranium served a special use and represented something more than just another dead dog in need of disposal.

A conventional, uncalibrated AMS radiocarbon date of 2600±50 B.P. on the bone gelatin of the canid was obtained from GeoChron Laboratories of Cambridge, Massachusetts (GX-25030-G-AMS). The date was consistent with those from Unit II from the previous excavation at the Costello-King site, though the depth below ground surface was slightly greater. Interestingly, the vast majority of features found at the Costello-King site, including the Late Archaic house, occurred in this unit (Ezzo and Deaver 1998). A stable isotope ratio (^{13}C) of -10 ‰

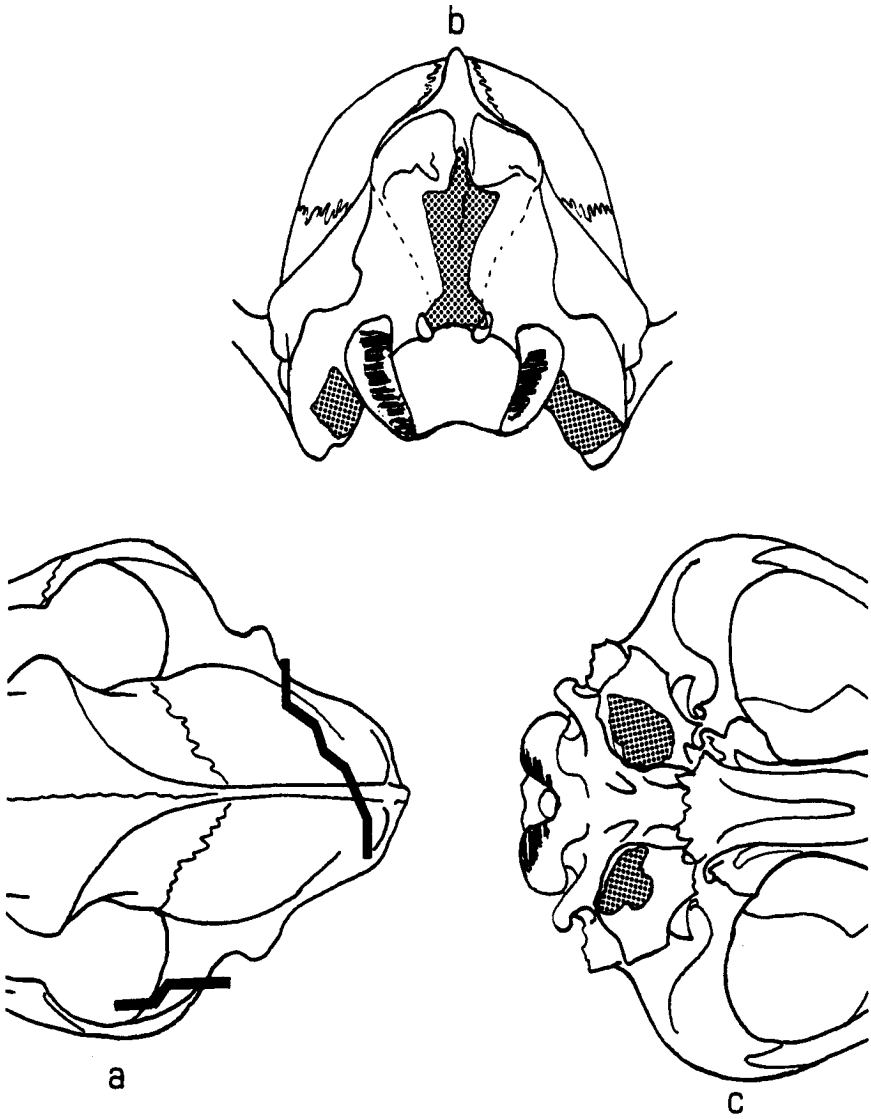

Figure 5. Location of tool-induced damage to canid cranium posterior: (a) two prehistoric fractures (bold lines; all other breaks appear to be recent or cannot be distinguished from recent damage; (b) posterior view of occipital triangle with "shaved" midline (see shading), cut-marked occipitals (bold hatching), and symmetrically broken auditory bullae (shading); and (c) basal view of breached auditory bullae (shading) and cut-marked occipital condyles (bold hatching). Skeletal drawings adapted from von den Driesch (1976:44–45) by Lois Kain.

was obtained from the gelatin, the significance of which is discussed below. Although in the past there has been a problem with bone dating younger than its actual age, the use of the ^{13}C when calculating age has largely negated this effect (Taylor 1987). Therefore, the conventional date obtained on the gelatin can be directly compared to the dates on maize from the Costello-King site.

EARLY CANID BURIALS IN SOUTHERN ARIZONA

According to Olsen (1985), the domestic dog derives from the wolf, *Canis lupus,* and nearly all specialists agree that it first evolved in the Old World by about 10,000 B.P. The domestic dog appears to have made an early entry into the New World; although early Holocene dates at Jaguar Cave, Idaho (between 9500 and 8400 B.P. [Lawrence 1966; Olsen 1985:31]), have now been challenged (see Clutton-Brock 1995), domestic canids from Fell's Cave in southern Chile have been reliably dated to be as old as 8,500 years (Clutton-Brock 1988).

In the New World, Allen (1920) distinguished three types of prehistoric domestic canids: small, short-faced, and large. Haag (1948) undertook a detailed metric analysis of 26 prehistoric Southwestern dogs, and his conclusions support Allen's classification. Others (Emslie 1978; Olsen 1985) have argued that no such distinctions exist, that small and large dogs grade into one another, and that size changes may be temporally conditioned; such arguments, however, are not clearly supported (James 1989).

Burials of Archaic and Early Formative period domestic canids are rare in southern Arizona (see Figure 1). Eddy and Cooley (1983) report that an articulated domestic dog skeleton was found in 1958 in a pit at the Donaldson site in Matty Canyon. The site, which has been re-dated and now likely has an initial phase of occupation between about 2300 and 2800 B.P., yielded a second canid burial in 1983, but flooding washed the remains away prior to excavation (Huckell 1995). The Santa Cruz Bend site, initially occupied around 2500 B.P., which lies on the Santa Cruz River floodplain south of the Costello-King site, yielded a domestic canid burial in a pit consisting of a cranium and disarticulated postcranial skeleton (Mabry and Archer 1998; Thiel 1998). Three domestic canid burials were recovered from the Early Formative Houghton Road site, occupied around 1800 B.P., which lies along Tanque Verde Wash. All contained cranial and disarticulated postcranial remains (Cairnes and Ciolek-Torrello 1998). Most recently, two features at the Archaic period site of Las Capas, located within a few kilometers of the Costello-King site, yielded evidence of interred canid remains. One feature contained two crania; disarticulated remains of the lower half of a dog also were recovered from a disturbed context (Jennifer Waters, personal communication 2000).

No detailed description exists for the canid burial at the Donaldson site. The buried specimens from the Santa Cruz Bend and Houghton Road sites appeared

quite similar. At both sites, the canids were small dogs, as defined by Lawrence (1966), and disarticulation of the postcranial skeleton was probably the result of rodent disturbance. There was no evidence of use of these individuals for food, though such practices have been inferred in the prehistoric Southwest (Hall 1945). The burial at the Costello-King site consists only of the deliberately severed cranium of a large, mature dog. As analyses are completed for the Las Capas site, however, the two crania interred in a pit may prove to be the result of human behavior as well. It should be noted that the temporal congruity and physical proximity of the Las Capas and Costello-King sites suggest that they in fact might be part of the same site or cultural complex.

DISCUSSION

Evidence for deliberate interment of dogs from Late Archaic and Early Formative contexts in the desert Southwest is still relatively scant. The recent intensification of excavation in floodplain areas of the Tucson Basin has located the majority of interments, and continued work will likely yield additional evidence. At least two distinct patterns of domestic canid interment have been documented. The more common pattern consists of the interment of the entire animal in an oval pit. This is evident from Late Archaic contexts at the Donaldson and Santa Cruz Bend sites, and the Early Formative Houghton Road site (Cairnes and Ciolek-Torrello 1998). In all cases, rodent and other postmortem disturbances are thought to have caused considerable disarticulation of the postcranial skeletons.

The second pattern, first identified at the Costello-King site and described in this article, consists of the head of the canid being placed into a shallow, circular pit. The remains at Las Capas, currently being analyzed, may conform to this treatment as well (Jennifer Waters, personal communication 2000).

It is possible that the size of the animal may relate to the form of interment. The burials at the Donaldson, Santa Cruz Bend, and Houghton Road sites were of small dogs, making interment of the entire animal possible in a fairly small pit. The dog from the Costello-King site was much larger. Perhaps only the heads of such large dogs were interred; however, it is entirely possible the postcranial skeleton of the burial from the Costello-King site is somewhere nearby. It is also probable that the cranium may have served some special purpose. The deliberate nature of the interment of the dog skull suggests that there may have been some type of ritual significance associated with it. Formative period evidence for such human behavior has been found in the Southwest (e.g., Eddy 1961, 1966; Hall 1945; Hill 2000).

Another source of information from the canid burial from the Costello-King site comes from the ^{13}C derived from the bone gelatin. In conventional terms, the ^{13}C of -10.0 ‰ suggests a diet containing a significant C_4 component (see Ambrose

1992; Katzenberg and Harrison 1997). C_4 refers to one of the two principal photosynthetic pathways utilized by plants, and the principal C_4 plant available for consumption at the Costello-King site would have been maize. Olsen (1985) discusses a number of possible roles that domestic canids likely played prehistorically. These include hunting, house or settlement guarding, and scavenging. The latter role would have been of great utility to humans, as dogs could minimize the amount of food refuse within a settlement, as well as consume human feces. Regardless of how dogs obtained maize at the Costello-King site, a significant C_4 signal must be a reflection of the patterns of human dietary consumption. The pollen and macrobotanical data from the site indicate the ubiquity of maize, and the presence of irrigation canals suggests that maize farming was important enough to warrant the development of water-control features. Although the evidence is scant, it is not unreasonable to infer that maize was a significant dietary component at the Costello-King site, and that human food refuse and occasionally human waste was scavenged by dogs. In addition, because bone gelatin is synthesized primarily from dietary protein, the ^{13}C of the canid suggests that a significant amount of dietary protein was derived from maize, indicating a diet that was relatively poor in meat. This may likewise reflect the human diets at the Costello-King site. From the above discussion, we infer that dietary studies of domestic dogs in certain prehistoric contexts may function as a proxy measure of human diets.

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